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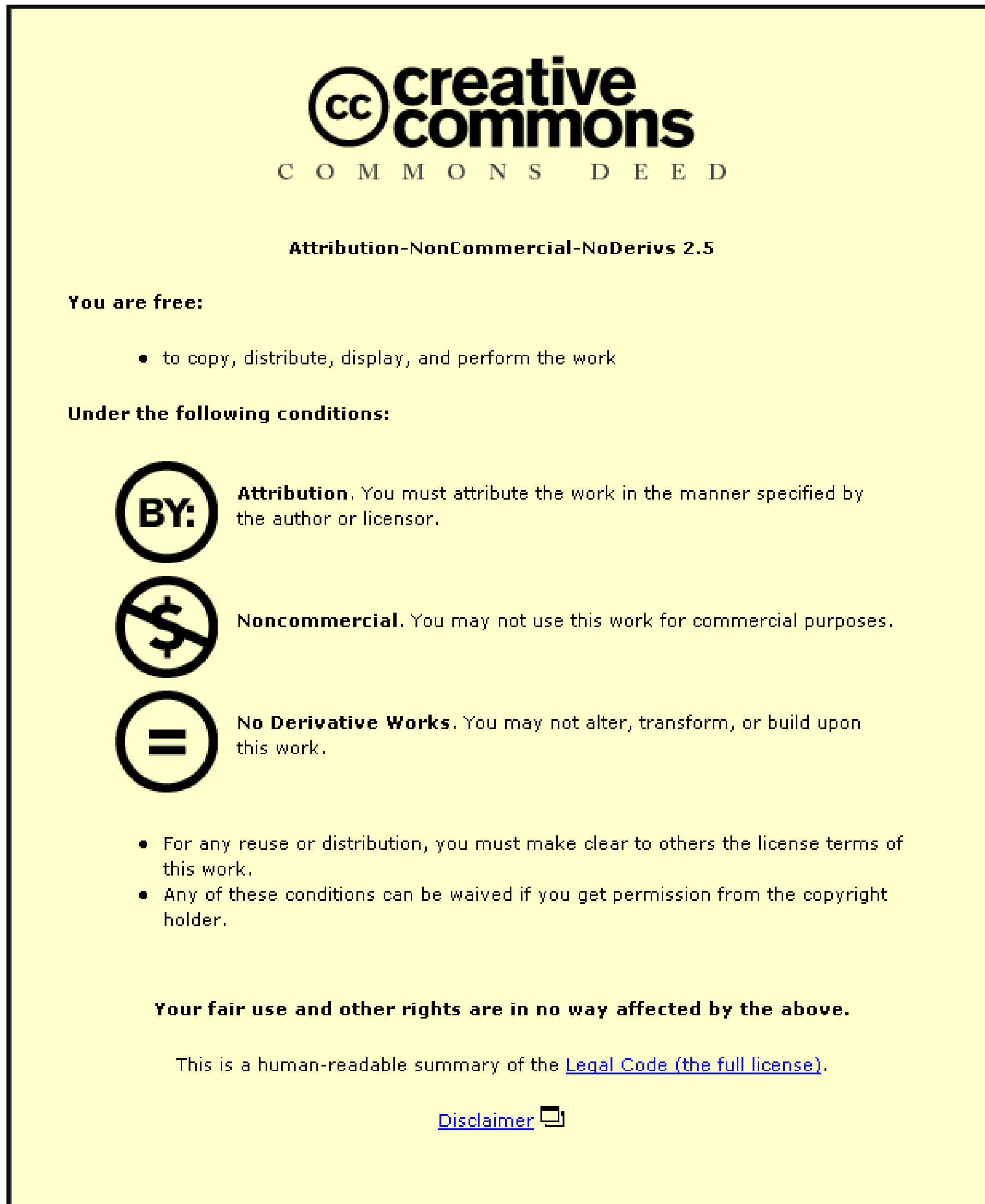
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**ASSESSMENT OF TOTAL QUALITY MANAGEMENT
IN THE SAUDI CONSTRUCTION INDUSTRY
ORGANIZATIONS**

By
Khalid A. F. Albayoudh

A Doctoral Thesis

Submitted in partial fulfillment of the requirements
for the award of

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March 2003

c Khalid Albayoudh

ABSTRACT

Total quality management (TQM) has been recognized by many countries to be one of the keys to competitiveness. Organizations in other industries are increasingly using self-assessment instrument to drive continuous improvement and direct the TQM journey in moving the organizations towards business excellence. In Saudi Arabia, many organizations implementing TQM are in need for a self-assessment instrument to assist in implementing TQM properly. There is a clear need to evaluate or assess TQM practices as a key part of the TQM implementation strategy within the construction industry organizations using an appropriate self-assessment instrument.

This thesis examined a novel approach for this problem through using Malcolm Baldrige National Quality Award (MBNQA) as the most suitable TQM model selected among 16 models used worldwide within the construction industry organizations. The developed TQM generic model is based on the selected TQM model with consideration for the Saudi organizational culture and the requirements of construction industry. The criteria in the developed TQM generic model were used as a framework that was translated into a multi-item questionnaire for assessing quality performance. Quality Assessment Instrument for the Saudi Construction Industry or “QAISCI” was developed and it has the potential to assist in implementing and assessing TQM. It contains TQM generic model, self-assessment questionnaire, scoring system and achievement assessment graph. Statistical testing confirmed that the self-assessment instrument is valid and there is significant correlation between the scores obtained from survey and that obtained from TQM assessors.

The research also describes the results of survey about the quality management practices carried out for 112 organizations consisting of clients, design consultants and construction organizations. The level of TQM awareness for construction client, consultant-design, and construction organizations were determined through QAISCI. The general level of TQM awareness for the construction industry organizations in Saudi Arabia appears to be “Enlightenment” or exactly in the early stage of “Enlightenment” with a percentage of progress towards full TQM implementation equals to 32%. The clients and contractors are realizing that continuous quality improvements have been made and some benefits in the business are visible. Design

consultants are seeing the first signs of improvement but still in the early stage of TQM journey.

The research also highlights on benchmarking and provides essential data for organizations. Benchmarking process showed that 13.64% of the consultant-design organizations and 20.94% of the construction organizations could be benchmarked to create continuous improvement.

Also, through the study, 57% of the participating organization indicated that the main benefit they found from implementing TQM in the business was “cost savings” and 39% stated that the major barrier was “changing the organization culture” towards a quality culture. In addition, 50% illustrated that “evaluation of performance by merit rating” was the main pitfall.

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CHAPTER 1

INTRODUCTION

Total quality management (TQM) has been recognized by many countries to be one of the keys to competitiveness. Global competitiveness is increasing at a phenomenal rate as more countries are embracing the free market model and opening up their borders for investment and trading. As an important region, Saudi Arabia needs to enhance the quality of its products and/or services.

TQM is increasingly being adopted by the construction industry organizations as an initiative for improvement and to solve quality problems in addition to meet the needs of the final customer. There is a pressure on organization to improve especially in the developing countries. In Saudi Arabia, the decrease in oil price has direct effect around the country. The reduced income in the government sector as a result of the reduction in oil price has increased the need for reducing costs. Also, the quality programs are gaining acceptance either as a way of maintaining a competitive edge or to increase productivity and improve performance. From this prospective and based on the need to improve products and/or services, the priority is to promote the importance of TQM measures and to create awareness for TQM. Therefore, It is essential to study TQM applications and transferability for the benefit of the economy and the advancement of the construction industry sector in Saudi Arabia.

In Saudi Arabia, there is a clear need to evaluate or assess TQM practices as a key part of the TQM implementation strategy within the construction industry organizations using an appropriate self-assessment instrument. The researcher believes that if ever an industry needed to take up the concept of total quality management (TQM) in Saudi Arabia it is the construction industry.

1.1 A brief introduction to TQM in the construction industry

The quality journey has evolved from inspection, through quality control and quality assurance, to total quality management (TQM). Organizations transformed from an

inefficient environment with reliance on inspection, an autocratic leadership and hierarchical control, to teamwork system, satisfying customers and doing quality right first time and improving the processes in continuous manner.

The philosophy of TQM provides the approach to realize the fundamental business strategy to focus on customers and stay lean. TQM practices help enhance business excellence through satisfying customers, reduce costs, increase productivity and enhance quality of outputs.

The foundations of this philosophy are rooted in the concepts of Deming, Juran and Feigenbaum who assisted the Japanese manufacturing industry in the early 1950's to improve the quality of its products and boost its exports. The awareness of the competitive importance of quality in Western countries started to grow since the 1980's by a new 'gurus' including Crosby.

The increased importance of quality in the market place in addition to the breakdown of tariff and other barriers based on the rules of WTO in 1993 implies that suppliers of goods and services that are of low quality will be under extreme pressure. As a result, those organizations that do not pay sufficient attention to the competitive importance of quality are unlikely to survive for long.

TQM involves every one in the organization in the effort to improve performance. Also, TQM permeates every aspect in an organization and makes quality a strategic objective. It is achieved through an integrated effort among personnel at all levels of the organization to increase customer satisfaction by continuously improving performance. It focuses on process improvement, customer and supplier involvement, teamwork, and training in an effort to achieve customer satisfaction, cost effectiveness, and defect-free work. It provides the culture and environment initiative for innovation and for construction technology advancement.

The TQM criteria measure leadership, information analysis, customer satisfaction, process management, strategic planning, human resource management, partnership, public responsibility, quality and operation results. These criteria are the main framework of TQM that seeks to assess an organization's quality related performance. Through these criteria, organizations need to show evidence of innovative approaches,

widespread deployment of these approaches, and a continuous improvement philosophy. These requirements are prerequisites for organizations to reinforce and improve quality in work processes, products and/or services.

The sustenance of TQM in organizations is a long-term effort. Many countries have established national quality awards for promoting and encouraging organizations having excellence in quality management practices. These national quality award programs promote quality awareness, recognize quality achievements of organizations and provide a platform for sharing successful quality management initiatives.

1.2 Research objectives

The main objective in this research was to **propose** an appropriate self-assessment instrument through developing a TQM generic model effective for the Saudi construction industry organizations compatible with the Saudi organizational culture. The developed TQM generic model was used to **develop** a self-assessment instrument to assist in implementing TQM properly and to evaluate or assess the TQM practices in the Saudi construction industry organizations. The self-assessment instrument was founded through developing the following main parts:

- a) Developing TQM generic model**
- b) Creating self-assessment questionnaire.**
- c) Determining criteria score (weight) for the TQM generic model.**
- d) Developing an achievement assessment graph for progress evaluation.**

The second objective was to **assess** the quality management practices for the Saudi construction industry organizations. The developed self-assessment instrument was used to:

- a) Evaluate the extent of TQM awareness within the Saudi construction industry organizations.**
- b) Provide the Saudi construction industry organization with process benchmarking as a tool for continuous improvement.**
- c) Also, part of focus in this study was to find out the benefits, barriers and pitfalls of implementing TQM in the Saudi construction industry organizations.**

1.3 Research methodology

The methodology used to satisfy the first objective was through the following steps. The first step was to **review** the literature of TQM and the practices especially in the construction industry. A **comparison** study was made for a number of TQM models used by construction industry organizations in some countries of the world and to look for any difference. The most suitable TQM model was selected and the required **modification** was run on the selected TQM model to suit the Saudi organizational culture and the requirements of construction industry and to form TQM generic model for the Saudi construction industry organizations.

The second step was to use the assessment areas of the developed TQM generic model to **create** a questionnaire-based assessment whereby the items to be measured would follow the exact nature and structure of the criteria of the developed TQM generic model. A survey was conducted through interview for a number of the Saudi construction industry organizations for **testing the validity and reliability** of the self-assessment questionnaire.

The third step was to find the level of importance for each criterion of the developed TQM generic model through the conducted survey and then an **analysis** using one of the advanced decision making theories for **determining** the score or weight of the criteria composing the TQM generic model.

The fourth step was to **develop** an achievement assessment graph using the MBNQA score scale, the ECI management awareness and the quality maturity grid developed by Crosby.

Also, the methodology used to satisfy the second objective was to convert scale of score (level '0' to '5') in the initial self-assessment questionnaire to another scale using the new scoring system that was computed for the developed TQM generic model. Using the validated self-assessment instrument, the survey results were combined with the literature research results to study **the extent of TQM awareness** within the Saudi construction industry organizations. In addition to categorization for the Saudi organizations to know the "best in class" in TQM implementation for

benchmarking purposes. Also, an additional questionnaire for knowing the business status and the TQM implementation practices were part of the conducted survey. The survey results were combined with the literature research results to study **in general the TQM benefits, barriers and pitfalls** within the Saudi construction industry.

1.4 Literature review

The literature research reviewed Total Quality Management in general through understanding the theory behind the management philosophy and the theory development in the last two decades. The revision was then supplemented with a literature research for the TQM implementation within the construction industry.

Studies of the use of TQM in construction industry are few. Two groups have been identified for their promotion of researches in construction industry especially in the area of TQM; the European Construction Institute (ECI) which has its headquarter in Loughborough University in the UK and the Construction Industry Institute (CII) in the USA. Also, other studies about TQM are presented in Chapter 5 through the comparison study between TQM models and performance measures.

The ECI research.

The ECI research about TQM in the construction industry was set up through a TQM Task Force in 1990 to investigate the implementation of TQM within the construction industry. A survey on the status of TQM amongst the ECI member companies was commissioned in 1990 at Manchester School of Management in UMIST by (Boaden, Dale and Polding, 1990). This research is probably a good reflection of the status of TQM within construction industry in the UK.

The ECI survey covers organizations representing all parties in the construction industry. The respondent was 28 organizations, 29% client, 18% consultants and the remaining 53% involved in contracting of one type or another. The results were:

- More than 50% of client organizations had produced a formal program for TQM, whereas only a third of the contractors group had done so.
- Clients had adopted TQM with little interest in QA whilst the contractors had entered the quality management area by the QA journey.

The CII research.

The CII research “quality management organizations and techniques” was effective in the US construction industry and was commissioned by the CII in 1989 by Matthews and Burati.

The CII survey concentrates on contracting organizations involved primarily in heavy industrial, manufacturing, or commercial construction. The report highlights on the suggestion that all parties should adopt TQM: clients, architects, engineers, contractors, suppliers and subcontractors throughout the entire process.

A total of 19 mostly large construction organizations were interviewed and the results showed that most of organizations participated in the study had either implemented or were in the process to implement TQM. Also, the study indicated that the implementation process requires about three years of effort before realizing the benefits in the organization.

1.5 Summary of conclusion

There is a need for a self-assessment instrument to assist in implementing TQM properly and to evaluate or assess the TQM practices in the Saudi construction industry organizations. The result in this research has raised some interesting issues and also reinforced the researcher’s arguments that there is a need for studies related to TQM implementation in Saudi Arabia. Based on the detailed study and the survey conducted and presented in this research, the following conclusions can be drawn:

(i) The comparison results for the TQM models and overall performance measures used within the construction industry showed that Malcolm Baldridge National Quality Award or “MBNQA” is more suitable for implementation within the construction industry sector. Easiness to understanding and updating, perception for customers, consistent in process, encouraging continuous improvement, and containing guide to scoring system are the preferred characteristics of MBNQA.

Quality Assessment Instrument for the Saudi Construction Industry or “QAISCI” was developed to assist in implementing and assessing TQM. It contains TQM generic

model, self-assessment questionnaire, scoring system and achievement assessment graph for progress analysis. The four parts forming “QAISCI” are presented in brief:

a) The developed TQM generic model is based on MBNQA and it is capable of guiding the construction industry organizations to implement TQM with consideration for the Saudi organizational culture and the requirements of construction industry.

b) The criteria of the developed TQM generic model were used as a framework that was translated into a multi-item questionnaire for assessing quality performance. Statistical testing confirmed that the self-assessment instrument is valid and there is significant correlation between the scores obtained using the developed self-assessment questionnaire and the actual scores obtained from TQM assessors. The correlation coefficients were 0.651 and 0.795 for the sub-criteria level and criteria level respectively.

c) The objective scoring system for the self-assessment questionnaire was determined from responses using the criteria of the developed TQM generic model that carried out for 112 organizations from the Saudi construction industry sector. The relative importance of each criterion in comparison with other criteria was the base for determining the weight. Analytical hierarchy process (AHP) was the method used for weight analysis. The analysis indicated that the difference is 15% between the weights of criteria in the developed TQM generic model and that of MBNQA.

d) The last part in the self-assessment instrument was the development of an achievement assessment graph. The graph was developed using the quality maturity grid presented by Crosby, the MBNQA score scale and the ECI achievement assessment graph. It provides the assessment process with a visible quality maturity level for the assessed organization.

(ii) The assessment of quality management practices in the Saudi construction industry organizations can be summarized as follows:

a) The level of TQM awareness for construction client, consultant-design, and construction organizations in Saudi Arabia were determined through QAISCI. The general level of TQM awareness appears to be “Enlightenment” or exactly in the early stage of “Enlightenment” with a percentage of progress towards full TQM implementation equals to 32%. The “merger” with another organization having the same nature of business to form an organization capable of competition in the market and the “acquisition” for some of the organizations facing troubles can improve the

performance of those organizations. The clients and contractors are realizing that continuous quality improvements have been made and some benefits in the business are visible. Consultants are seeing the first signs of improvement in the activities of the organizations but still in the early stage of TQM journey.

b) Benchmarking process, through learning from best in class, is another way for improvement and the results in this research showed that 13.64% of the consultant-design organizations and 20.94% of the construction organizations could be benchmarked to create continuous improvement in the business of construction industry.

c) Through the study, 57% of the participating organization indicated that the main benefit they found from implementing TQM in the business was “cost savings”. Also, it was found that 39% stated that the major barrier was “changing the organization culture” towards a quality culture and it is true in the case of organization owned by a family. In addition, 50% of the participating organization illustrated that “evaluation of performance by merit rating” was the main pitfall and it can be true especially in the early stages of TQM implementation.

1.6 Guide to the thesis

This research is basically divided into three parts:

- 1- Background research (Chapter 2,3,4).
- 2- Comparisons of TQM models, verification of the developed TQM model, and results (Chapter 5,6).
- 3- Conclusions (Chapter 7).

Chapter two is a review of literature related to the subject of Total Quality Management. The aim of this chapter is to:

- Clarify the principles, the elements, and the implementation of TQM.
- Comment on its applicability to the construction industry.

Chapter three covers the findings of a review of literature related to the Quality Management Systems. The aim of this chapter is to explain the quality control, and the quality assurance. Also, it highlights on the road for transition from TQ to TQM and the causes of quality deviations in design and construction.

Chapter four presents an overview for the Saudi construction industry including the organizational and quality culture.

Chapter five covers the comparison in details of TQM models and performance measures used within the construction industry organizations. Description for the contents, similarities and differences for the current TQM models and measures used within the construction industry. Also, the main traits of each TQM model were presented for selecting the best TQM model such as: 1) easiness to understanding and updating, 2) perception for customers, 3) consistent in process, 4) encouraging continuous improvement, and 5) guide for scoring system.

Chapter six covers development of the self-assessment instrument in addition to validity and reliability study for the self-assessment questionnaire. The self-assessment instrument was presented in four parts and they are:

- a) TQM generic model
- b) Self-assessment questionnaire
- c) Scoring system
- d) Achievement assessment graph

The analysis of data for TQM in practice for the Saudi construction industry sector is also illustrated in this chapter for three types of organizations and they are:

- a) Client organizations
- b) Consultant-design organizations
- c) Construction organizations

The attributes of TQM which are being applied in the Saudi construction industry organizations were also presented in this chapter to show:

- a) The real status of TQM and the level of TQM awareness.
- b) Benchmarking process for the Saudi construction industry organizations
- c) The findings in TQM implementation based on the followings:
 - 1) Benefits
 - 2) Barriers
 - 3) Pitfalls

Finally, **Chapter seven** presents conclusions on the results of this research.

CHAPTER 2

TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) has become one of the important forces leading to organizational success and company growth in the market. TQM is a complete management philosophy concerning quality that were initiated in the West and developed in the Far East. The application of TQM in the construction industry has improved the competition position of the construction industry organizations.

In TQM: the client satisfaction is objective in every initiative; the business process improvement is continuous in the services delivered from an organization; and the empowerment of every one in the organization by providing training, skills and knowledge to do the best possible service. The customer satisfaction and the continuous improvements are the principles of TQM and the elements of TQM form the framework for supporting these principals.

Different theories of quality management appear to talk the same language that quality has to be managed. Oakland (1988) has structured the TQM models in five parts: foundations, systems, tools, teams and implementation.

The TQM models used internationally in the construction industry organizations differ in the number of TQM elements but they have almost the same fundamental elements.

2.1 Definition of TQM

TQM is defined by Macdonald (1993) as: “TQM” stands for total quality management where:

- Total means that every one in the organization is involved in the final product or service to the customer.
- Quality means the conformity to requirements.

-Management means that TQM is managed process which involves people, systems and supporting tools and technologies”.

The European Construction Institute (ECI, 1996) defined TQM as: “ TQM is a management-led process to obtain the involvement of all employees, in the continuous improvement of the performance of all activities, as part of normal business, to meet the needs and satisfaction of the customer whether internal or external ”.

The Construction Industry Institute (CII, 1993) defined TQM in a brief expression stating that “ TQM is a management philosophy that effectively determines the needs of the client and provides the framework, environment, and culture for meeting them at the lowest possible cost ”.

Also, TQM in other expression is “ an effective, comprehensive management techniques that has proven successful both overseas and in the U.S.A, in manufacturing, in service and in construction organization ”.

2.1.1 Principles of TQM

The fundamental goals of TQM are customer satisfaction and continuous improvement and thereby the principles upon which are based. Customer satisfaction and continuous improvement are interdependent and are accomplished through the TQM elements.

- Customer satisfaction.

The term “ customer ” is defined as the one who pays the bills. And the term “ satisfaction ” is defined as the result of some comparison process in which expectations are compared with what is actually received. TQM effectively determines the requirements of the clients and provides the framework, environment, and culture for an organization to meet these requirements at the lowest possible cost. When the quality at each stage in the design construction processes are assumed, the final facility will in turn satisfy the customer.

Each work process consists of stages that have their own product, market, and customer. Also, each stage receives feedback from its customer to determine what changes should be made in its methods and procedures. The information collected from customers can be analyzed to decrease the gap between the customer needs and the performance of the present process.

In general, customer satisfaction went through four revolutions. In the 1970's, satisfying customer was through offering the lowest cost. In the 1980's, quality of the product became the main concern of the customers but in the last decade (the 90's) delivery speed got attention of customers and became the favorite of customers in addition to the cost and quality. Also, it is expected that agility - a capacity for rapid change and flexibility- is going to become the prevailing trait in satisfying customers (Zairi, 2001). In other word customer delicacy will take a big part of the story.

There are factors determine how customers evaluate service quality. The followings are the main factors:

1. Reliability: the ability to perform the promised service dependably and accurately
2. Responsiveness: the willingness to help customers and provide prompt service
3. Assurance: the knowledge and courtesy of the employees and their ability to convey trust and confidence
4. Empathy: caring, individual attention
5. Tangibles: the quality of the work product and the appearance of personnel

The factors described earlier were evaluated to know the weight of each factor through a survey (Culp et al., 1993) for 91 customers dealing with design consultant organizations in the united states. The results show that both responsiveness and assurance attained 32%, the empathy 18%, reliability 12%, and tangible 6%. Therefore, customers place heavy emphasis on non-tangible factors in defining service quality.

- Continuous improvements.

The continuous improvement is part of the management's responsibility in an organization and under TQM, the management has two functions: to maintain and incrementally improve current work procedures through process control, and to direct

efforts to achieve major advances in the technology of the design and construction processes through innovation.

In every Design and Construction organization, there are processes by which all work is accomplished. Each phase of the design and construction is itself a process. Through the use of flow diagrams every process can be broken down into stages. The work flows in, changes of state, and flows out to the next stage are the base for continuous improvement and then satisfying the customers at the next stage by analyzing the procedures directing the change of state to achieve an ultimate quality level.

One of the procedures to maintain and incrementally improve work methods is Deming's Plan – Do – Check – Act (PDCA) cycle as shown in Figure 2.1.

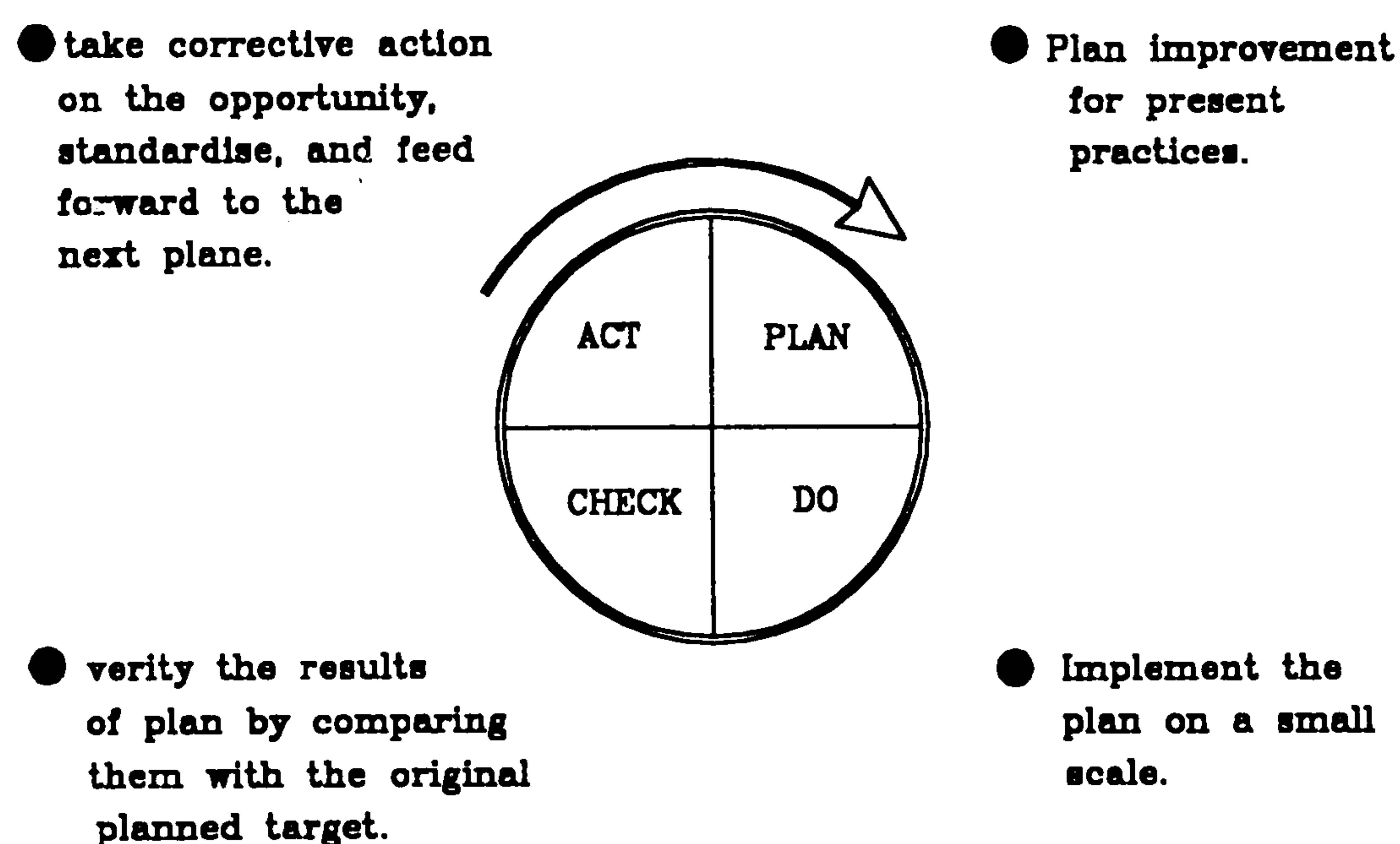


FIG.2.1 : THE PDCA CYCLE.

Innovation needs support of research and development by organizations and directing enough financial resources by management. The major shifts in the level of design and construction performance can be achieved through innovation. Once established, these new levels of performance have to be maintained by the PDCA cycle in order to avoid their deterioration. Figure 2.2 illustrates the relationship between incremental improvements, maintaining the performance, and innovation.

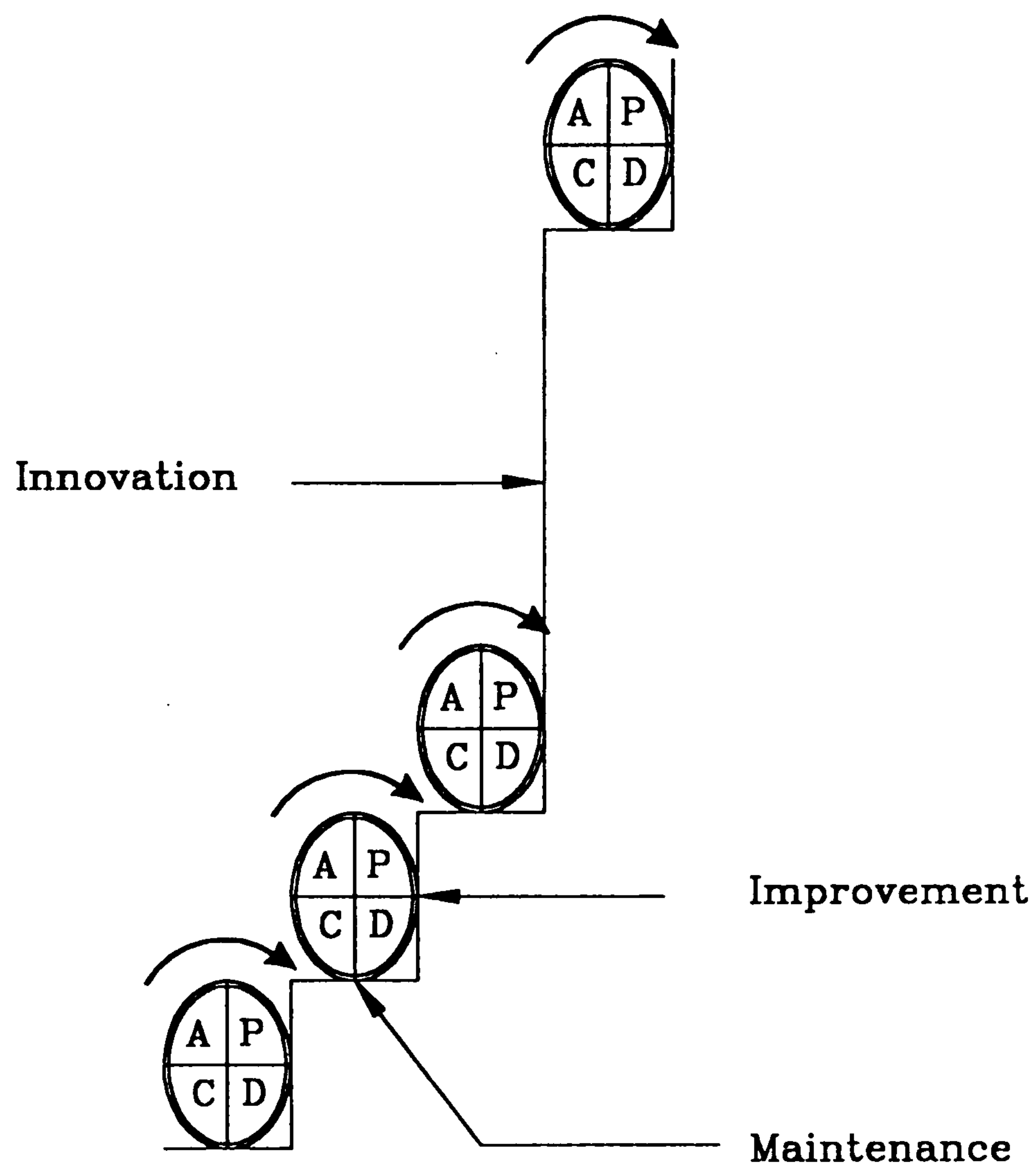


FIG.2.2 :THE RELATIONSHIP BETWEEN IMPROVEMENT,INNOVATION AND MAINTENANCE.

2.1.2 Elements of TQM

The fundamental elements (criteria) of TQM as identified by Oakland are the followings:

1- Understanding Quality.

The reputation of an organization is built by four elements: quality, reliability, delivery and price. The important element is the quality, which can improve the reputation through good management for the quality program in an organization.

Quality is meeting the customer requirements and throughout all organizations, these are a series of internal suppliers and customers that form what is called 'quality chains'.

The top Managers from throughout the organization need to be assembled for TQM orientation and training session.

2- Commitment and leadership.

TQM starts at the top, and it is essential step toward implementing TQM. The CEO should carry the responsibility for commitment to change and prepare the organization for continuous improvement that never ends. There are many ways that management can demonstrate its commitment to a quality policy and deals with its customers, suppliers, employees and systems.

Effective leadership starts with the CEO's vision and the characteristics of the effective leadership are clear objectives and beliefs, effective and clear strategy and plans.

3- Customer relationship.

Customer satisfaction is the ultimate goal of an organization and any project team. The commitment for customer requirements as mentioned before should start from the top management. Before the stage of satisfying the customer is reached, a concentrated effort is required to understand client requirements.

Determining user requirement is a key factor in TQM implementation, therefore; in the construction industry, the organization must design and improve in continuous manner user systems that focus on creating, improving, discovering and adding value to the customer.

4- Supplier relationship.

The parties involved in the process of producing a quality product are; the supplier, the processor and the customer, and the ability to improve the quality of the product mainly depends on the relationship between the mentioned parties.

The quality of work performed by the contractor is mainly related to the parties: the designers, the suppliers and the subcontractors. The quality of the specifications and drawings comes from the designers; the quality of the materials and equipment comes

from the suppliers and the quality of the work performed by the subcontractors. Therefore; the long-term relationships with the supplies are very important to the contractor in order to achieve a quality product.

5- Design for quality.

The competition on business is based on the quality needs to update the products, processes and services.

The invention and design, of a new product is innovation. And continuous improvement of existing products, services and processes is also innovation. The design process often needs technological innovation to response to the changing in market requirements and trends in technology. In quality design, all aspects of the customer's needs such as cost, safety and easy use take place through identifying the need, developing that which satisfies the need, checking the conformance to the need, and ensuring that the need is satisfied. The commitment of top management is required for building quality throughout the design process.

Quality Function Deployment (QFD) is a system needed in TQM to design a product or service based on the requirements of the customers where QFD team can determine who are the customers?, What do the customers need? , and How will the needs be satisfied?.

6- Planning for Quality.

Planning is a basic requirement for effective TQM in all organization. The quality planning must be part of the continuous review process, which looks for zero defectives through the strategy of continuous improvement. Planning for quality sets out details for systems, procedures, purchased materials or services, plant and equipment, process control, sampling and inspection and training. Flowcharting is a method to record the series of events and activities, stages and decisions in a form that can be easily understood and communicated to all people in an organization.

7- System Design and Contents.

A suitable documented quality system is necessary for attainment the objectives of the quality policy. The quality system needed for implementing TQM must contain the components, such as the organizational structure, responsibilities, procedures, processes and resources.

The International Organization for Standardization ISO 9000-9004 contains methods that are used to implement a system. It is recommended that the system should follow the PDCA cycle during documentation, implementation, audit and review.

The activities in an organization are generally processing, communication and control and these activities should be documented to form a quality manual.

8- Quality system audit/ review and self- assessment.

Quality system is an important element in TQM. There are two main methods for error or defect prevention; checking the quality system and error/defect investigations and follow-up. To check the quality system, audits and reviews are generally used. The successful quality system functions with a suitable audits and reviews where the audits to make sure that everything is adhered to documented procedures and the reviews to ensure that the quality system achieves its goal.

9- Measurement of Quality.

Measurement is very important in comparing internal and external performance and in determining problem areas and savings. It may be necessary for evaluating performance precisely, to measure effectiveness, efficiency, quality, impact, and productivity. There are many types of measurements such as comments and complaints from customer, any information from the customer or employee surveys, etc. Benchmarking is a measure for the operations, products and services of an organization against other competitors to establish priorities, operations, and targets to lead to advantages that help in competition. Benchmarking has four types: internal, competitive, functional and generic.

The analysis for costs of quality gives an assessment for the effectiveness of managing the quality and of clarifying problem areas, and savings.

10- Tools and Techniques for Quality Improvement.

For continuous improvement in TQM, numbers and information are the base for understanding decisions and actions. Simple tools are needed to interpret and drive maximum use from data. Also, another sophisticated techniques, such as brainstorming, analysis of variance and design of experiments etc, are used sometimes. The management should support the people who work on the processes by training them how to use the tools in an effective way.

11- Organization for Quality.

The internal dynamics between departments reflect the management systems in organizations. The integration between the marketing, design, sales, production/operations and accounting should give the interests for customers and suppliers. The quality function should encourage and facilitate quality improvement. In large organization, a quality director will participate to the prevention strategy and in small organization, an external TQM advisor is usually required to support the quality director who works in a part-time basis.

12- Teamwork.

Once the quality teams are established, the steering committee continues to provide direction for maintaining the TQM process.

The internal quality consultants or facilitators have an extensive knowledge of TQM, and are qualified to provide training to other individuals in the organization such the quality team leaders. Depending on the size of the organization, quality teams may be necessary at divisional and departmental levels. The divisional managers are members of the steering committee and leaders of the division level teams. Also, the departmental managers are members of the division level teams and leaders of the departmental teams.

The use of the team approach to problem solving has many advantages. It allows individuals to work separately on problems to tackle a greater variety of problems, it exposes the problems to a greater diversity of knowledge, skills and experience, and it implements more likely the recommendations which come from teams suggestions.

13- Communication.

The strategy of changes towards TQM must be brought in clear and direct form of communication from the top management to all staff/employees in the organization, and the good leadership is mostly by good communication.

The attitude and behavior of staff/employees can be affected by communication and good communication. Also, the attitude of people can be changed through gaining their acceptance.

Total quality message is the first step in communication and it should be followed by TQM directive. People should know when and how they would get into the process. Also, what the process is, and the benefits from achieving the TQM. All these steps need to be brought in simple and short language between functional groups in the organization, in addition, the communication and participation must be used in all levels and in open way without barriers by concentrating on the process rather than other departmental issues.

14- Training.

Once the commitment from top management is present, quality training should be continuously performed. Training of the top management team in the basics of TQM is an essential step. The training program should be part of the quality policy where the responsibilities, organization, needs, monitoring and assessing of results are essential in the improvement cycle.

The training efforts should include construction in the basics of TQM, cause and-effect analysis, team problem solving, interpersonal communication and interaction, cost of quality measurement and statistical method.

15- Focusing on employees and recognition.

TQM recognizes that every employee has significant potential to make improvement. Through motivation, instilling the internal customer concept and training of employees are very important factors to satisfy and gain the attention and effort of employees.

The work environment should be safe, clean and stimulating to satisfy the employees. Also, encouraging two-way communication and employees suggestions are needed. It is important that to remove barriers inside and outside the organization, to allow employees in participation, problem solving and decision making, and to provide individual and team recognition for quality improvement in order to succeed in implementing TQM in an organization.

2.1.3 Implementation of TQM

There are some steps that are common to organization who have implemented TQM. The steps are similar to the four steps of the PDCA cycle, and they are:

i) Preparation and planning

When senior management becomes familiar with TQM, through reading books of quality, visiting TQM organization who have already implemented TQM and by attending seminars. They should start to assemble the quality supporting structure “quality committee” for implementing TQM and it is recommended they begin to apply on some selected pilot projects.

The quality committee consists of: leaders from different areas and levels of the organization, a quality consultant, and steering teams at the department level to direct the implementation effort down into the department. The leaders and the quality consultant should start to formulate the quality approach for applying TQM to the organization.

Management should not simply buy a “TQM program” and blindly apply it to the organization but they should develop their own quality program that best suits the

culture and requirements of their organization. Therefore, the management can adapt a program that is developed by one of the quality experts or by studying all of the different approaches in the same business and develop a customized approach. When the new approach is formed, the committee can start to work on a detailed plan for implementing the TQM process throughout the organization. The implementation plan should involve the followings:

- 1- The mission and vision statements and the quality policy should be prepared in a new and carefully worded to exemplify the management commitment to quality.
- 2- The funding procedures for team training and other related activities should be determined.
- 3- The annual and mid-term goals for the TQM process have to be developed.
- 4- The management should offer education for every employee about the approach, promotion for the TQM process and recognition for the team success stories.

ii) Implementation of the plan

The quality approach for implementing TQM should be assembled gradually on the basis of some selected pilot projects. As the momentum of the process increase, the effort can be extended to the rest of the organization. The next step is to announce to the employees that the implementation of TQM has started in the organization for future benefit. Then, the steering teams are formed from each department to direct the quality improvement efforts in each department. The quality consultant should provide assistance to the steering teams to get the TQM process down into the quality teams within the department.

Also, training should be carried out as soon as the quality teams begin to form. In addition, the team is used to communicate the new organization quality policy and goals to unify the efforts of improvement. As the implementation plan succeeds through the pilot projects, then it can be applied in all the organization.

iii) Measuring and verifying the implementation

As the process progresses, a comparison of the effectiveness should be made against the control points and measures established at the preparation and planning stage.

Monitoring these measures is very important step and should be done carefully using an appropriate self-assessment instrument. Also, verifying the conformance of the measures to the initial plan is the last step in this stage.

iv) Evaluating the results and continuing to the next

An evaluation for the achievement of the annual goals is performed and new ones are determined. It is necessary to identify and correct gaps in the organization performance. The mid-term goals are reevaluated in light of the progress and adjustments are made accordingly.

Self-assessment is used in evaluating the performance progress for organizations. The interest in self-assessment has grown with the advent of quality awards such as Malcolm Baldrige National Quality Award (MBNQA) in 1987 and European Quality Award (EQA) in 1991. Self-assessment is defined as a comprehensive, systematic, and regular review of the activities and results of organizations referenced against a model of business excellence. The self-assessment instrument consists of questionnaire that reflects the organization status towards full TQM implementation. It allows the organizations to identify and correct gaps in their performance. Also, organizations do benefit from a quick measure of their current quality performance without having to go through a formal quality award application. It provides an input to continuous improvement of the business (Hellsten et al., 1999).

2.2 TQM and the construction industry

The construction industry is facing many challenges forcing organizations to reevaluate their performance. In construction, the productivity is down, the litigation is up and delays are common and costly and the reasons for these problems are complicated. TQM is certainly one of the differentiating factors now and in the future since the construction industry are currently facing a lack of quality which is considered as one of the reason behind the problems facing the construction industry.

TQM involves every one in the organization in the effort to improve performance. TQM permeates every aspect in an organization and makes quality a strategic objective. It is

achieved through an integrated effort among personnel at all levels of the organization to increase customer satisfaction by continuously improving performance. It focuses on process improvement, customer and supplier involvement, teamwork, and training in an effort to achieve customer satisfaction, cost effectiveness, and defect-free work. It provides the culture and environment initiative for innovation and for construction technology advancement.

The construction industry is often criticized for its poor performance on quality, cost, safety and speed and it has numerous problems because of its complicated nature of operation (Kanji et al, 1998). As suggested by Oakland and Aldridge (1995), if ever an industry needed to take up the concept of TQM it is the construction industry.

One of the unique features in the construction process is that each project is to some extent different with other project. Also, changes in the details of the design of a project happen excessively throughout the construction process.

TQM, supply chain management (SCM) and partnering are approaches that can be applied as initiative for solving the construction industry problems and meeting the needs of final customers.

TQM will provide a quality system and procedures for the work of the different parties. However, even with the cooperation of the partners in the supply chain and the quality systems and procedures in force, good performance cannot be obtained without the development of a quality culture (Kanji et. al, 1998). Therefore, quality culture must be established along the supply chain to insure that every one understands the importance of quality and each party serves the needs of others and by this concept everything will be right first time.

2.2.1 Supply chain management in the Construction industry

The supply chain in the construction industry may be owner, consultant, contractor, subcontractors and suppliers. Christopher (1992) defines a supply chain as “ the network of organizations, systems and integrative approach to managing operations and relationships among the different parties in a supply chain. It builds the trust and

cooperation, creates improvement and coordination and exchanges the information of the market between parties.

In the supply chain, The poor performance of one party is going to affect the performance of the next party. Each party should work to provide best performance by communication with other parties and teams in the construction industry.

When the owner decides to invest in a building project, he hires a consultant to design the project then the contractor is selected to build the project as per the drawings and specifications of the consultant. The contractor always needs subcontractors to participate in building the project. The subcontractors are sometime chosen by the owner. The required materials for building the project need suppliers, either to hand them to the contractor or to the subcontractors.

Suppliers becomes more significant in strategic issues on projects i.e. development in design and innovation in technology and processes and their consequent involvement earlier in the design process (McCaffer et al. 1999). A structured process was developed to illustrate both the complexity and increase in strategic importance of the supplier involvement. Figure 2.3 shows that the increase in complexity and strategic involvement of suppliers causes that the industry to shift away from the traditional procurement towards more collaborative relation characterized by:

- i) Developing fewer ‘best’ deeper business relationships.
- ii) Rationalizing the supplier base.
- iii) Differentiating between strategic supplier and commodity.
- iv) Understanding the capabilities and competencies of the supplier.

The lack of continuity in relationships causes prevention for process innovation and improvement, and decrease the chance to develop more complex relationship. Therefore, a supply chain has to be built for every project. The concept of ‘ supply network ’ is more relevant since there are multiple numbers of suppliers for each product and service. In the supply network, the knowledge base consists of SCM database and project performance database which can be used for benchmarking issues such as time, cost and quality.

One of the elements of TQM is ‘ customer and supplier involvement ’ and in the SCM there is also a series of customer and supplier relations where the output of one party is the input of the next party. TQM supports SCM through cultivating a quality culture in an organization and with a good system, the effective performance of the supply chain can be accomplished.

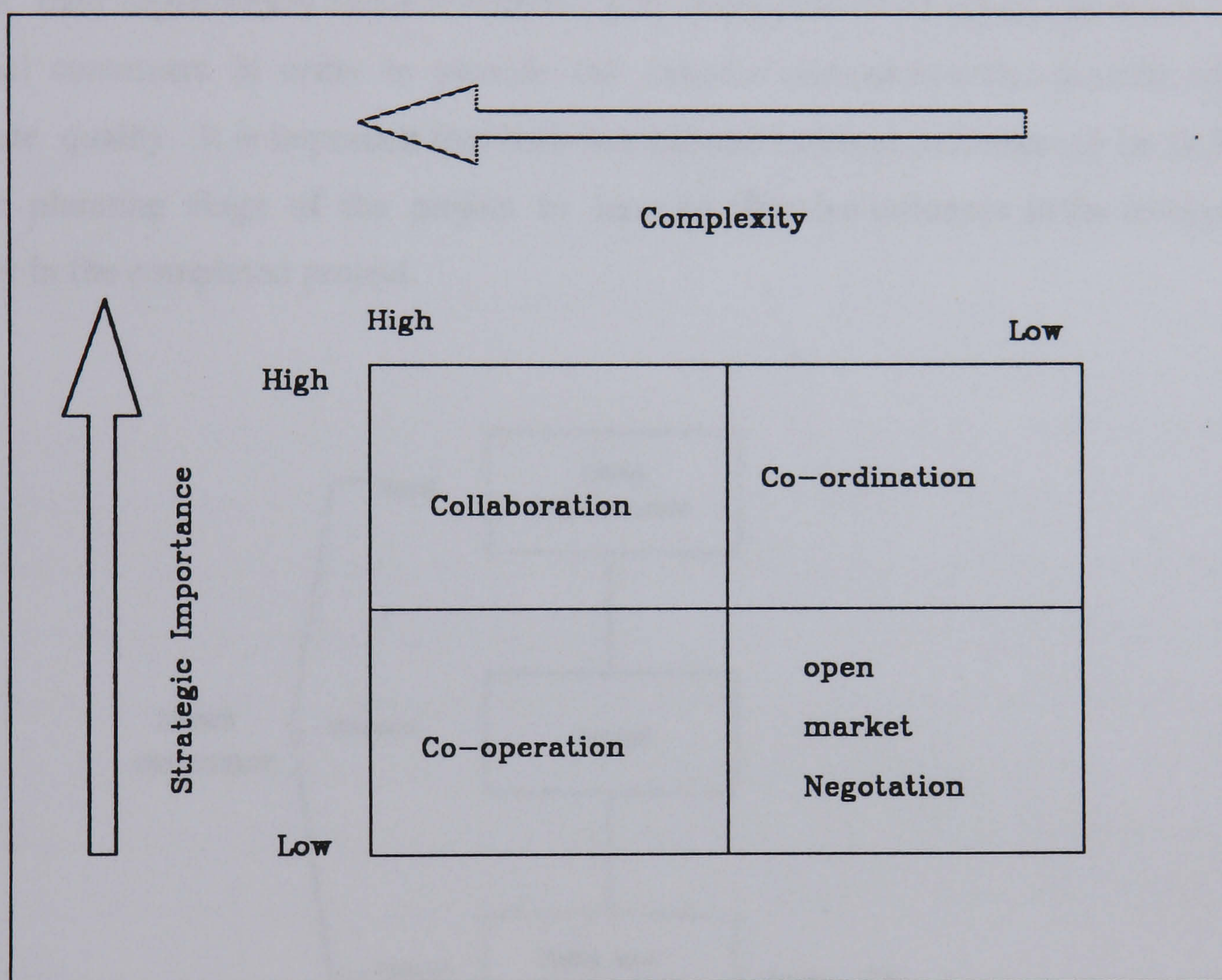


FIG.(2.3): Complexity Strategy Matrix (McCaffer 1999)

2.2.2 Meeting the client’s requirements in Design and Construction

The function of the construction industry is to provide the clients with a structures or facilities “ product ” to meet their requirements and is simply expressed as “ the chain of events to produce a facility taking the clients requirements as the initial input ”.

Customers can be either internal or external. External customers are not part of the organization producing the product but they are affected by it. In the engineering design, the products are plans and specifications and the customers are the owner and the construction organization. In construction, the product is the completed project “facility” and the customer is the final user of the facility.

Also, there are customers within the Design and Construction organizations. The internal customers receive products and information from other individuals or groups within their organization and it is essential part of the process to satisfy the needs of the internal customers in order to provide the external customers with a product with an ultimate quality. It is important that both internal and external customers to be included in the planning stage of the project to have an effective influence in the level of the quality in the completed project.

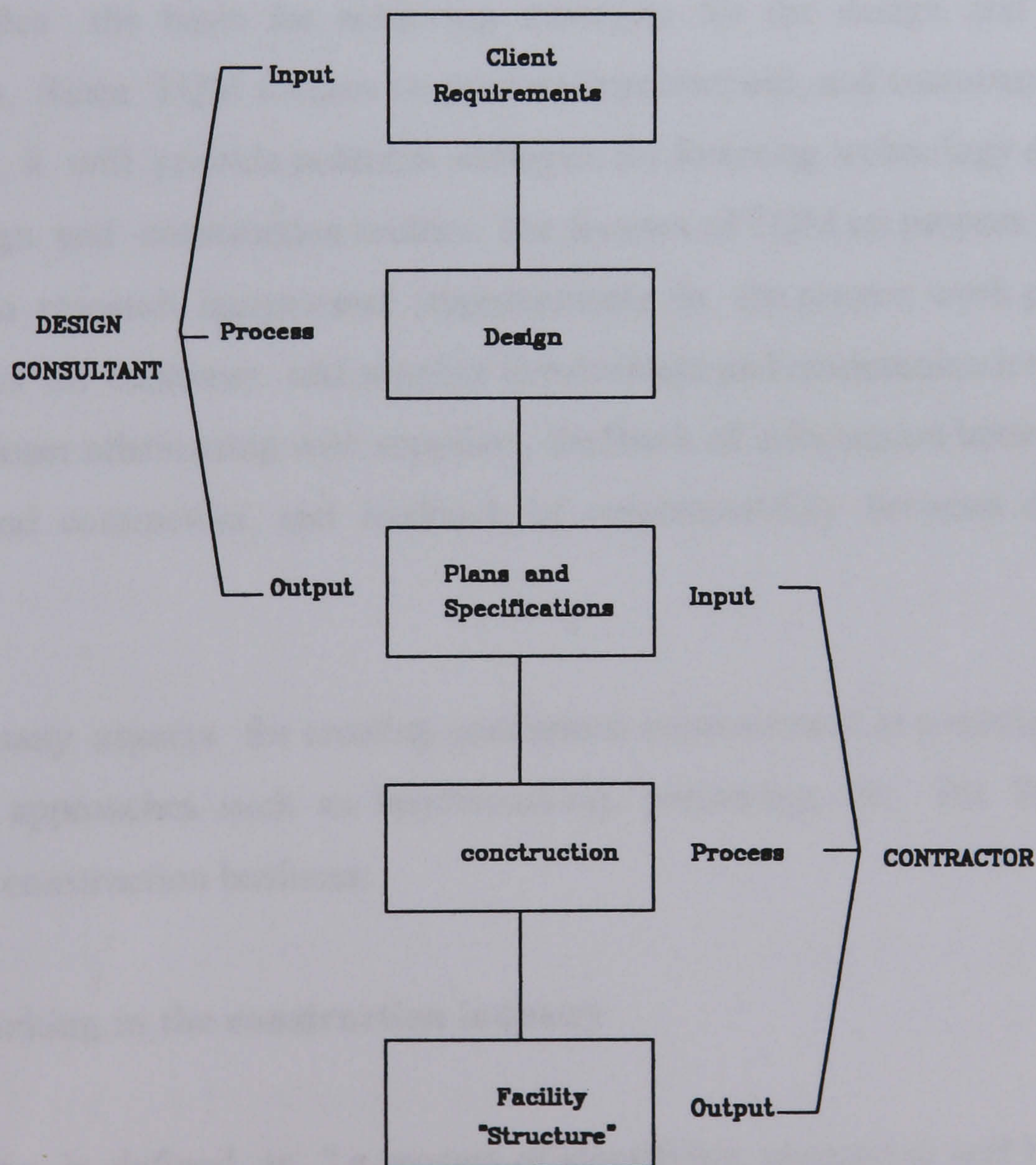


FIG.2.4: ROLE CONCEPT FOR THE THREE PARTIES IN CONSTRUCTION

The “ triple role ”is defined by the guru ‘Juran’ that each party has triple role which means each party in the process plays three roles: supplier, processor and customer. These three roles are performed at every level of the construction process, as illustrated in Figure 2.4 where the design consultant becomes: a customer of the owner, a processor of the design and a supplier of the plans and specifications to the contractor. Also the contractor becomes; a customer for the design consultant, a processor of the construction and a supplier of the facility to the owner.

2.2.3 Continuous improvements and innovation in the construction industry

Achieving improvements and obtaining advanced technology are functional strategies that are essential for an effective business. There is a strong relationship between the vitality of an industry and its development effort.

TQM provides the basis for achieving strategies for the design and construction organizations. Since TQM focuses on process improvement, and customer and supplier involvement, it will provide potential strategies for fostering technology developments for the design and construction sectors. The focuses of TQM on process improvement will result to research incremental improvements in the present work process. Also, TQM focuses on customer and supplier involvement and communication...etc. which will give closer relationship with suppliers, feedback of information between users and designers and contractors, and feedback of constructability between designers and contractors.

There are many aspects for creating continuous improvement in construction industry using new approaches such as benchmarking, partnering...etc. The followings can improve the construction business:

1- Benchmarking in the construction industry

Benchmarking is defined as “ a process of identifying, comparing and learning from ‘ best in class ’ products, services and practices to set an agenda and promote a culture of

continuous improvements within an organization ”. It is simply an informal meeting between organizations to exchange information and experience about specific subjects in the business.

There are two types for the benchmarking approach:

i) Process benchmarking which is a comparison of individual practices with best practice as a tool for learning among benchmarking participants for continuous improvement. In process benchmarking, a detailed description of all activities that comprise best practices is the result of benchmarking. A project or a defined phase of a project can be benchmarked and single construction project can not be benchmarked in isolation but at least with one another project or more.

ii) Performance benchmarking which is a comparison of cost; time or any measurements needed to complete any specific work within a certain process model of best practice. This type of benchmarking can be between identical construction projects or between every activity in generic categories such as standard business functions or trade skills, which can be broken down to their basic elements. The activity under consideration should be understood. A best in practice organization performing this activity is then identified and finally a comparison is made usually using a number which expresses the level achieved in that activity. In benchmarking, there are five stages, they are:

- i) Planning.
- ii) Data collection.
- iii) Analysis of data.
- iv) Acceptance of results.
- v) Action for improvement.

The benchmarking is considered to be a useful tool in the construction industry and can have an advanced form such as “ benchmarking club for Design Consultants or Contractors ”, and can be managed and funded, for example, by “ the chamber of commerce ” since it is the leader for such work.

ECI benchmarking model

The ECI (European Construction Institute) benchmarking model by assumption consists of five Phases:

- Feasibility design.
- Scheme design.
- Detail design.
- Site construction.
- Site commissioning.

There are a number of activities that need to be performed as part of a best in class project within each phase and in each process. Also, the amount of effort needed by each process varies at each stage. Benchmarking can be carried out in five levels, which depends on the comparison extent with other organization, and the independent level of auditing used, these levels are:

- A simple, unaudited self- assessment of a single organization.
- An unaudited self-assessments of more than one organization.
- An audited assessment of a single organization.
- Audited assessment of more than one organization
- Audited assessments and comparison against a database developed from results of other members of a benchmark club.

2- Partnering in the construction industry

Improvement in construction project performance can be done by many ways. One of the important ways is ‘ partnering ’. It describes the business relationship between customers, contractors and suppliers working together on a project (or several projects), sharing the risk and rewards ECI (1996).

Partnering is a philosophy of teamwork and cooperation, and is one of the pillars of TQM (Kanji et al. 1998). Partnering and SCM focus mainly on a close working relationship between different parties in the construction project. SCM supports project partnering since it deals with the different parties as one integrated team to insure best performance.

Replacing usual adversarial relationships with cooperative relationship can reduce project costs and this concept will provide the following:

- i) The costs associated with disputes during construction will be minimized.
- ii) The flow of information will be more freely and openly among parties by avoiding errors, misunderstanding and confusion.
- iii) The mutual understanding can provide efficient, cheaper and more constructable designs.

Partnering requires the leadership and commitment of top management of all the organization involved in a building project to drive the partnership and support it with a formulated contractual framework. TQM with partnering provides an ideal environment for the construction industry.

3- Opportunities of quality improvements in Design and Construction

In design and construction processes, many opportunities for quality improvement can be developed. If plans and specifications are more carefully reviewed, corrections can be made before the documents are issued for bidding but this review and corrections add time and costs to the design. Most design firms spend 25-50% of design man-hours redoing work that had already been done once (Stasiowski et al. 1992).

During construction and start-up, a major disconnects are discovered because design professionals and owners fail to devote enough effort to early definition of requirements.

CHAPTER 3

QUALITY MANAGEMENT SYSTEMS IN DESIGN AND CONSTRUCTION

The international Standard Organization (ISO) defines the term quality as “ the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs” where the stated needs are determined by a contract or specifications and the implied needs are a function of the market.

The following factors are part of the needs:

- i) Safety
- ii) Availability
- iii) Maintainability
- iv) Usability
- v) Reliability
- vi) Price
- vii) Environment

All these factors can be translated into specifications except the factor price where it can be defined in monetary units. The specifications should be measurable for providing a quantifiable and operational definition of quality. Quality management system is required to achieve the specifications of the product or service. There are three levels for the quality management system: Quality Control (QC), Quality Assurance (QA) and Total Quality Management (TQM). In this chapter, quality control and quality assurance are described in details and the third system was already described in chapter 2.

3.1 Quality Control

ISO defines quality control as “ It involves operational techniques and activities aimed both at monitoring a process and eliminating causes of unsatisfactory performance at relevant stages of the quality loop in order to result in economic effectiveness”.

Quality control is simply performed by inspection under which one or more properties of a product are examined, tested, measured or compared with specified criteria for assessing the conformity. Any product that does not meet the requirements is either scrapped, rework or passed. Quality control system is a screening process without prevention content.

3.2 Quality assurance

Quality assurance is defined by the British Standards Institute (BSI) as “all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality”.

Quality assurance is important in the engineering and construction industry because of the risk involved in any project. It is essential that a built-in quality assurance system is developed to avoid any inefficiency that could cause in poor quality of products and service. The quality system required for QA is based on the meeting of the requirements through a set of standards and defined procedures rather than cultural change. Also, the emphasis with QA is towards prevention of defects and problems known as non-conformance rather than detection of non-conformance.

3.2.1 Quality standards

One of the developed quality system standards is the ISO 9000 standard that has been applied in many industries. The idea of the ISO 9000 standards started in 1974 when the BSI introduced the guidelines BS 5179 to document the quality system for organizations. A new standard BS 5750 consisting of three major parts was introduced where the first represents the highest level of standards and the third represents the lowest.

In 1987, ISO issued a series of documents, ISO 9000 to ISO 9004 where the basis for the ISO 9001 to ISO 9003 were the three parts of the BS 5750 standards. ISO 9000 and ISO 9004 are related to the application of ISO 9001 to ISO 9003 as follows:

ISO 9000: guide to selection and use.

ISO 9004: guide to quality management and quality system elements.

ISO 9001: model for quality assurance in design/development, production, installation, and servicing.

ISO 9002: related closely to ISO 9001 and details for production and installation but excluding design/development.

ISO 9003: related closely to ISO 9001 and details only for final inspection and testing.

There is an advanced ISO standard known as ISO 14000 that is concerned with environmental performance. The ISO 14000 provides organizations with the elements of an effective environmental management system which can be integrated with other management requirements to assist organizations for achieving environmental and economic goals. It has been written to be applicable to all types and sizes of organizations and to accommodate diverse geographical, cultural and social conditions

Organizations may elect to use an existing management system consistent with the ISO 9000 series as a basis for its environmental management system. Quality management systems deal with customer needs and environmental management systems address the needs of parties and society for environmental protection.

3.2.2 Requirements

The various requirement clauses contained in ISO 9001 are explained briefly below:

- 1- *Management responsibility*: for defining the organization's quality policy and for indicating the communication throughout the organization.
- 2- *Quality system*: for establishing and maintaining a documented quality system.
- 3- *Contract review*: for establishing documented procedures for contract review and for the co-ordination of activities.
- 4- *Design control*: for establishing documented procedures for controlling and verifying of product design.
- 5- *Document control*: for establishing procedures to control all documents and data pertaining to ISO 9001 requirements approved by authorized persons prior to issue.

- 6- *Purchasing* for ensuring the purchases conform to requirements.
- 7- *Control of customer-supplied product*: for establishing documented procedures for verifying, storing and maintaining of purchaser-supplied items for use in production.
- 8- *Product identification and traceability*: for establishing procedures for identifying the product at all stages of production, delivery and installation.
- 9- *Process control*: for ensuring the production and the installation are planned, documented and carried out in accordance with ISO 9001.
- 10- *Inspection and testing*: for providing objective evidence of no incoming product is used or processed prior to inspection.
- 11- *Inspection measuring and test equipment*: for controlling, calibrating and maintaining inspection, measuring, and testing equipment.
- 12- *Inspection and test status*: for establishing well-documented procedures for identifying the acceptability of products with regard to inspection and tests.
- 13- *Control of non-conforming products*: for establishing procedures for preventing accidental use or installation of non-conforming products.
- 14- *Corrective action*: for establishing procedures for investigating and rectifying of all instances of non-conformity.
- 15- *Handling, storage, packaging and delivery*: for establishing procedures for handling, storage, packaging and delivery of products to prevent damage or deterioration.
- 16- *Control of quality records*: for establishing procedures for keeping records for easy access.
- 17- *Internal quality audits*: for planning, executing and documenting a comprehensive program of internal quality audits to evaluate the quality systems effectiveness, to a certain whether quality activities conform to planned arrangements.
- 18- *Training*: for establishing procedures for identifying and meeting the training needs.
- 19- *Servicing*: for establishing procedures for servicing and for meeting the requirements of servicing.
- 20- *Statistical techniques*: for initiating procedures for checking process capability and conformance to product specification.

The organization must document its quality system in a “ quality manual” that becomes the responsibility of the quality manager. The quality manual should include the followings:

- Quality policy statement.
- Organization structure and responsibilities.
- Definition for the various responsibilities for each activity affecting quality.
- Description for the products and services within the organization.
- Authorized signature (specimen) for final acceptance of products and services within the organization.
- Details for document control.
- Reference for terms.

3.2.3 Certification to ISO 9000

Certification may be a pre-qualification requirement in the contractual conditions or for tendering, and as a result some organization achieve certification and get internal benefits from the experience.

Certification process requires action for identifying responsibilities, training needs, and setting out work methods. Developing a documentary control in the organization will benefit the business although the target is holding ISO 9000 certificate. Certification might be an initiative for the top management to have a commitment for continuous improvement.

The certificate is awarded after auditing the quality requirements by an independent external body. It subjects to annual or biannual review audit and it must be renewed as per the rules. The certification body must get a formal recognition of competence to carry out quality audits from the accreditation department.

The Saudi accreditation body is under the responsibility of the Saudi Arabian Standards Organization (SASO). Also, there are requirements for certification bodies applying for accreditation and more than six formal certification bodies are working in the Saudi market few of them are representing a foreign companies. Figure 3.1 shows the progress towards ISO certification in Saudi Arabia through the last eight

years (SNQC, 2001). More than 600 organizations certified for ISO 9000 from year 1993 to year 2001.

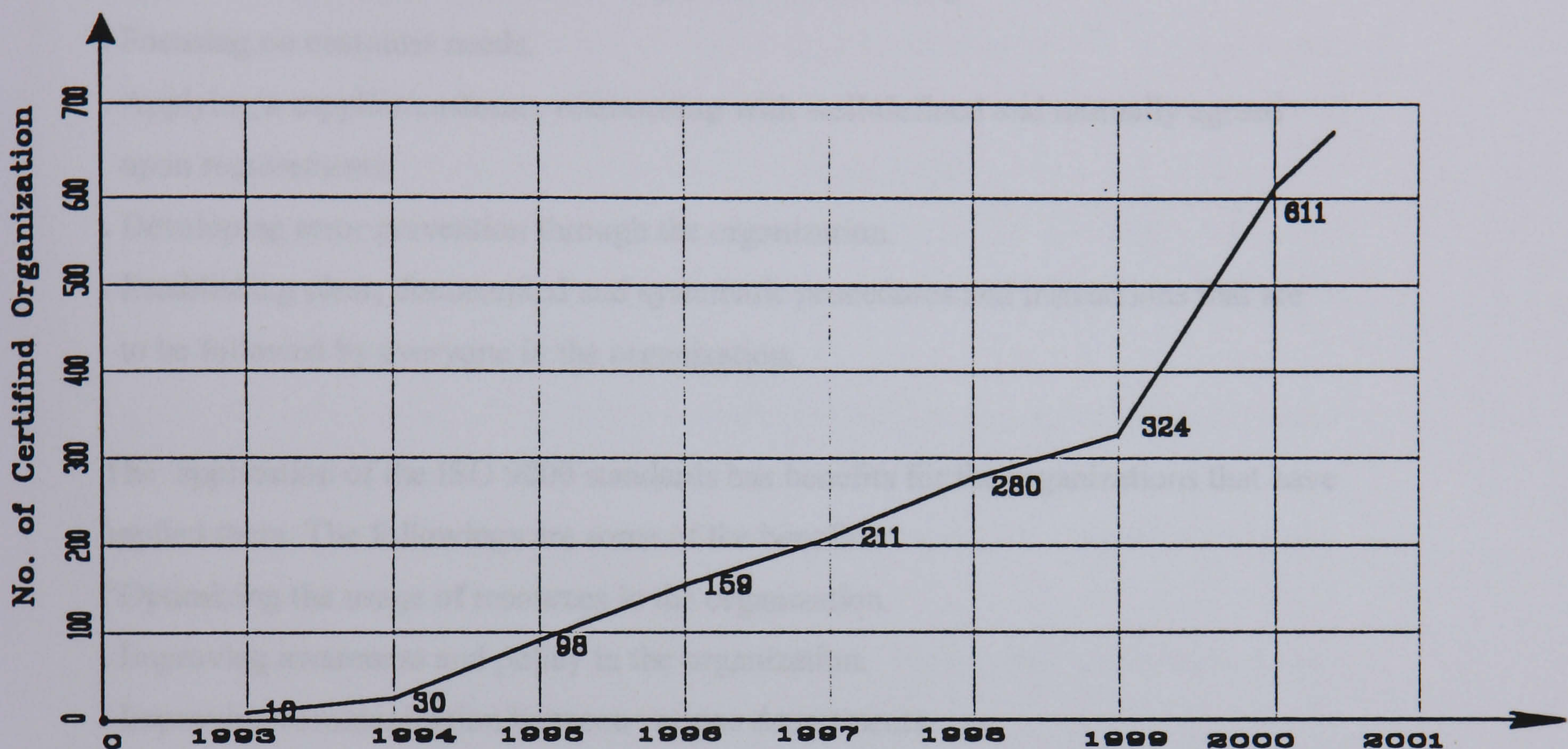


Figure (3.1):ISO 9000 Certification in Saudi Arabia(SNQC, 2001)

3.2.4 Benefits and pitfalls of implementing quality systems using ISO 9000

The quality standards have been written essentially for the manufacturing industry and as a result the terminology used in the quality standards do not reflect the way in which the construction industry works.

The acceptance of ISO 9000 standards in the construction industry is not as wide as in other industries such as manufacturing. There are special features in the construction industry limit the implementation of the ISO 9000 standard such as the uniqueness of construction project...etc. (Bubshait et. al, 1999).

McCaffer (1990) believes that the move to quality assurance in the construction is a fundamental shift in basic approach.

Implementing the ISO 9000 standards will improve the competitive edge of any organization as a result of the following (Chew et. al, 1996):

- . Focusing on customer needs.
- . Applying a supplier/customer relationship with well-defined and mutually agreed upon requirements.
- . Developing error prevention through the organization.
- . Establishing clear, documented and systematic procedures and instructions that are to be followed by everyone in the organization.

The application of the ISO 9000 standards has benefits for the organizations that have applied them. The followings are some of the benefits:

- . Optimizing the usage of resources in the organization.
- . Improving awareness and policy in the organization.
- . Improving communication between various departments.
- . Reducing material wastage.
- . Improving tractability of quality problems.
- . Formalizing system for ensuring consistent quality services.
- . Providing useful documented reference.
- . Rectifying errors and mistakes at early stages.
- . Improving the relationship with the owner, subcontractors, consultant and suppliers.
- . Introducing continuous improvement through a review of the quality system.
- . Improving the corporate quality image.
- . Etc.

McCaffer (1990) states that quality assurance has major benefits for the construction industry. On the Engineers side, specifications will develop greater precision and the need to specify requirements in measurable standards will grow. Contractors will continue to develop greater self-reliance and grow a way from the inspection mentality.

There are some pitfalls that are encountered when implementing the ISO 9000 standards within the construction industry. Some of the major problems are:

- . Lack in management commitment: due to the pressure in the market and lack of awareness of the benefits of the quality system. The implementation of quality system faces difficulties or discontinues.
- . Unclear understanding for the terms of quality standards: the documentation requirements and the terms of quality standards for the construction industry need more interpretation to work within the context of the industry.
- . Ignorance of the fundamental documentation requirements: the huge amount of paper work generated from the activities in the construction industry is difficult to control or use without documentation system.
- . Ignorance of training: ISO 9000 is not only a documentation system but also needs training for employees about the process control, inspection, testing.
- . Change resistance: the transition to QA faces resistance in the organization and it needs a program for culture change.
- . Difficulty in controlling the subcontractors: ISO 9000 needs effective and clear standards to deal and control the subcontractors.

One more problem that is facing the program of QA within the Saudi construction industry is:

- . Communication difficulties between personnel: the language differences between personnel (multicultural) in the same organization cause obstacles for the success of QA program.

3.3 Causes of quality deviations in Design and Construction

The parties in the construction industry have become increasingly aware of rising construction costs and perceptions of increased quality problems. They agreed that a percentage of the cost was used to correct mistakes and it is possible to increase the profit by reducing the cost of poor quality that is accounted to be at least 7.5 of the value of new nonresidential work (Burati et al., 1992).

Quality deviations in design and construction are common in the industry and happen in all types of construction such as new construction, retrofit construction, and

upgrade construction. The followings are a classification for the design and construction deviations:

i) Design deviations: it can be either design errors resulting of mistakes and errors made in the project design, or design omissions resulting of omitting a necessary item or component from the design. Also, the design changes occur when changes are made in the project design and requirements. Design changes can be:

- For improvement through the design process.
- At the request of the field or construction personnel.
- Due to the field conditions in retrofit or up grade projects.
- In the process of constructing a facility.
- Changes initiated by owner, fabricator or supplier

ii) Construction deviations: it can be any deviation related to the construction phase such as construction errors result from the construction methods or procedures, or construction omission occurring due to the omission of some construction activity or task. Construction changes are usually made for enhancing the constructability of the projects.

There are another types of deviation such as: fabrication deviations related to shop fabrication, transportation deviations related to the transport of equipment, materials or supplies, and operability deviations made to the operation or process portion of the facility and other changes made to improve operability.

Design deviations averaged 78% of the total number of deviation and 9.5% of the total project costs. Also, construction deviations averaged 16% of the total number of deviation and 2.5% of the total project costs(Burati et al., 1992).

3.4 Transition from QA to TQM: achieving a change in culture

The culture of an organization is the unique configuration of norms, values, beliefs, ways of behaving and so on that form the manner in which groups and individuals combine to get things done.

Other definition for the organizational culture that it consists of many attributes such as language, artifacts and symbols, pattern of behavior, basic underlying assumptions, and subculture.

There are four main types of organizational culture providing a useful framework for considering change. These types are presented as follows in term of the organizational structure where they are typically exists (McCabe, 1998):

- i) *Power culture*: one person or a small group controls the organization. This type is unlikely to encourage developing the environment of TQM.
- ii) *Person culture*: individuals exercise professional independence. This type will be appropriate for TQM if the individuals deal with a single customer or a few customers.
- iii) *Role culture*: this type is also called bureaucratic culture where stability, rigidity and mechanistic structure are needed. It is not appropriate for TQM environment.
- iv) *Task culture*: The goal in this type is to get the job done even though there may be some administrative rules. It is flexible and fosters teamwork that is the base for creativity and quick response to customer requirement; also, it is most likely match TQM environment.

There are two approaches for changing culture of an organization, they are:

- i) *Planned approach*: a top-down changes and involves moving from one step to another in a series of preplanned and predictable steps. Senior management controls the decision to move towards their desirable culture. Four change phases are given below to illustrate the planned cultural change:
 - a- Exploration for an alternative.
 - b- Planning for the change management.
 - c- Action for achieving the change.
 - d- Integration of the change with the organization system.
- ii) *Emergent approach*: a bottom-up change and an open-ended and continuous process of adoption (McCabe, 1998), this approach is based on this belief and is considered a recent approach in comparison with planned approach. It becomes effective when:

- a- The structure determines the way that people relate to one another.
- b- The facilitative management becomes the way the managers act to bring together different parts of the organization to share problems and develop change initiatives.
- c- The organizational learning is the way of making the organization better and able to respond to changing markets by contribution of all people.

3.4.1 The change towards TQM

Any organization that thinks to implement TQM is preferred to have a quality assurance program even without ISO 9000. TQM is not as clear as ISO 9000, whereby a certificate is given for those who successfully passed the conditions. If an organization is attempting to move towards implementing TQM, it is necessary to address the organizational structure (McCabe, 1998).

Change is often resisted especially in an industry such as construction. In many construction organizations, ISO 9000 may be regarded as adequate and enough for their needs but some organizations are still looking for more improvements through quality. Therefore, it can be said that the start of the transition from QA to TQM comes through the people's attitudes towards quality, which can be called ' a cultural change '.

Three elements are important for treating change resistance, they are:

- 1- Top management support
- 2- Placing people who believe in TQM in positions
- 3- Heavy involvement of people in the field

CHAPTER 4

THE SAUDI CONSTRUCTION INDUSTRY

The total area of Saudi Arabia is around 1,960,582 sq. km and a population of 22,757,092 people includes 5,360,526 non-nationals (ministry of planning July 2001). Saudi Arabia has experienced rapid economic growth since the time of oil rise during 1970. Development of the infrastructure has been one of the priorities. The construction activities in general reach an average of 12 % of the Gross National Product (GNP).

Revenue from oil, gas and petrochemicals exports is the major national income. The variations and decline in oil prices in the 1982-1998 has forced the Saudis to reduce government expenditure in most of the sectors of its industries and to concentrate on non-oil products for supplementing the national income through diversified sources. And as a result, many businesses that had been supported by local government are now realizing the challenges ahead in the next millennium and are looking at quality initiatives as away for improving the products and services. The construction industry started to implement quality initiatives for improving the business of construction in Saudi Arabia.

4.1 Description of the Saudi construction industry

The major client in the construction industry is the government, through its ministries and various government institutions in addition to other public corporations such as the Saudi electrical consolidated company, the railways authority, the Saudi telephone company...etc.

While many industrial nations are facing recession today, Saudi Arabia stands out among advancing industry in different aspects of the national economy. This reflects the volume of the management capabilities of the government as well as the Saudi

professionals who have gone to faraway places to educate themselves and returned to participate in the nation's progress.

Also, the private sector is taking initiatives to create an investment climate for foreign partners.

The governmental projects that have been primarily performed on time reach only 30% of the total number of projects (AL-Jarallah, 1983). This means that a high percentage (about 70%) of the total number of projects are delayed and hence subjects to delay penalty.

Many obstacles face the Saudi construction industry and cause delay and are included in the followings:

- All unskilled and semiskilled labors are imported from Far Eastern and Middle Eastern countries giving an unexpected (Low) rate of productivity.
- Most sizable projects involve major components of foreign equipment, materials, and engineering, which reach the site late.
- The harsh climate reduces labor productivity and machine life.

The objective of this chapter is to present an overview of the Saudi construction industry with respect to:

- The Saudi organizational culture
- Special features of the Saudi construction industry
- The management strategy of the public and private organizations
- WTO expected effect on the Saudi construction industry
- The size and distribution of the market within a certain historical period.
- Contracting in the public and private sectors.
- Professional organizations and the responsibility for project design and construction.

4.1.1 Introduction to the Saudi organizational culture

Before entering in the details of the organizational culture of the Saudi construction industry, a highlighting on the national culture of Saudi Arabia is presented for more knowledge about the Saudi culture.

Hofstede (1984) indicated in his study for 45 countries that the national culture in Arab nations has a large power distance collectivist, large power distance masculine, and etc. Therefore, the characteristic of the Arab national culture is collectivist-masculine with large power distance.

TQM approach encourages group work and decision “or collectivist” through teamwork. Also, based on the nature of the construction industry “as a hard job” most of the employees are men, therefore, the cultural dimension “masculine” does not conflict with TQM. Power culture is not the preferred type for TQM environment as mentioned in chapter 3. Most of the private sector and the profitable governmental companies, in the Arab world and especially in Saudi Arabia, are having “task culture” in managing their companies as a new management style.

Most of the people in Saudi Arabia are religious and attached to the Islamic directions that dictate the people should treat labors fair and paying their wages on time and the employee or labor should do their work or duty well.

Each project in Saudi Arabia has a different characteristics and culture. The industry culture may be considered the shared ideas and beliefs that are associated with the way the industry operates where each organization will have its own unique set of values that it will bring to the construction site.

Also, key members in the organizations that operate at site influence the culture of the construction site. Few organizations allow more work to be completed off site for reducing the construction time scales and the overlap of construction activities. The adoption of quality management systems is evidence of contractor’s willingness to review working practices through learning from other industries such as “manufacturing”.

Human resource problems in the Saudi construction industry are similar to some extent to other industries where the lack of career and less loyalty to the organization become the main problems of human resources.

The absence of an organization that regulates the safety and health requirements for people working at site has caused a slight involvement of the contractor.

The followings are the main points in the Saudi organizational culture. They are; management strategy, construction industry features and WTO expected effect.

1- Management strategy of the Saudi public and private organizations

The national goals and objectives for the Saudi public and private organizations can be summarized as follow:

- Continuation in economic independence through diversification.
- Development in workforce.
- Expansion in export.
- Creation opportunities through investment.
- Transfer of technology.

To understand the management characteristics in the Arab nations especially in Saudi Arabia, One should review the commercial, industrial and infrastructure activities. The misguided impression that these nation have limitless wealth through oil discoveries and that money alone can make wonders in a nation's development are not realistic.

By judgment from the introduction mentioned above about the Saudis success in developing their nations. The major consideration of the Saudis management in either the public or private organizations can be summarized as follow (Al-suliman et. al, 1994):

- 1- Maintain a high profile of commitment to Islamic ways of life that induce to move ahead with discipline, unity, to march toward progress, and prosperity.
- 2- Ensure provision of basic needs for people, through housing, food and health care not only for Saudi citizens but also for workers and professionals from other countries.
- 3- Emphasize the importance of education and facilitate higher studies and professional advancement by assisting Saudis through financial support, in-

kingdom training programs and overseas studies.

- 4- Engage outside help for technology transfer and other services as needed through partnering...etc, and treat foreigners fairly in compensation and benefits.
- 5- Develop a plan for an early saudization process by training Saudis to replace expatriates where feasible.
- 6- Encourage foreign and domestic investments in developing product for civil and military requirements.

Also, the second strategic target in the Saudi seventh plan for year 2000-2005 states that the principles of TQM and value engineering should be implemented to improve the quality of project performance and other services. In addition to reducing the cost of projects using the techniques of value engineering (Ministry of finance, 2000).

The organizational culture of the Saudi organizations could be said to be dominated by educational, people-oriented, customer-focused, and long-term financial considerations. Therefore, the Saudi work environment is appropriate for applying the new management approaches such as TQM.

2- Special features of the Saudi construction industry

Some special features that make the construction industry in Saudi Arabia different from that industry in the rest of the world include a shortage of local contractors, local consultants, and local labor force; a shortage of local materials; extreme climate; a working year of 305 days; and a multinational influence.

The unique features in the Saudi work environment are as follow:

- 1- Many Saudi organizations are still depending on foreign technology and expertise for producing standard quality products and services.
- 2- The dependency on foreign workers either skilled or semi-skilled labors in the construction industry causes a multicultural work environment.
- 3- Few Saudi organizations have started to seek drastic reduction in foreign manpower and substitute them with nationals.
- 4- The local rules in Saudi Arabia state that;
 - a) All materials, for the governmental projects, should be purchased from the

Saudi local factories.

b) A maximum of 30% of the contract value the main contractors can sub-contract.

c) The main foreign contractor, if invited to bid in special projects, must subcontract a minimum of 30% of the contract value for Saudi contractors.

5- The harsh climate especially in summer season is affecting the productivity rate.

6- The Saudi government manages many industrial sectors; the privatization of public organizations has started to contribute to the success of the industries such as the construction industry.

3- WTO expected effect on the Saudi construction industry

The purpose of this part is to present the expected effect of the WTO (World Trade Organization) on the Saudi construction organizations concerning the competition with the foreign construction organizations who have an advanced quality management systems in engineering and construction services.

The government of Saudi Arabia has signed the agreement at year 1996 and becomes one of the 117 countries of the world accepting the WTO agreement and will open the Saudi market for the WTO members to work.

According to the classification of the WTO for the economical activities, there is no a classification under the name “contracting or contractors” but there is a classification named “ the construction and engineering services ” in the fifth section of the agreement.

It is expected that WTO will have a negative effect on the Saudi construction industry. If the engineering and construction organizations do not improve the quality system in their organizations so that they can have fair competitiveness with the foreign engineering and construction organizations who have already advanced quality management systems.

The chamber of commerce (1996) in Riyadh performed a pilot study about the effect of the WTO on the construction industry in Saudi Arabia through questionnaire

designed for construction organizations. It was found that 35.7% of the respondents have mentioned that the construction organizations are not able to compete with the foreign contractors because of the lack in the quality management systems.

4.1.2 The size and distribution of the Saudi market

During the last three decades, Saudi Arabia has experienced unprecedented construction activity that has attracted construction professionals from all over the world. Construction projects worth SR 774.5 billions (£141 billions) have been executed in Saudi Arabia during the last 20 years. In the second development plan (1976-1980), the expenditure on construction projects are about SR 158.5 billions (£29 billions) which is about 32% of the totaled during this period. In the third development plan (1981-1985), the expenditure on construction was SR 247 billions (£45 billions) and this improvement in the expenditure in construction is the result of the increase in the oil prices.

During the fourth development plan (1986-1990), the expenditure on construction was SR 166 billions (£30 billions) and this represents a fall in the construction turnover in comparison with the previous years as a result of the general economical crisis.

Also, in the fifth development plan (1991-1995), the expenditure in construction was SR 203 billions (£37 billions) which is more than the expenditure in the fourth development plan as a result of improvement in the oil prices as shown in Figure 4.1.

This construction turnover reflects a huge construction market, which is the largest in Gulf States and slightly smaller than that of the UK.

Projects of all types and sizes have been executed: housing units, highways, dams, international and domestic airport, seaport and refineries. The demand for basic infrastructure and housing has largely been met and a shift has started toward construction of industrial and commercial projects.

The turnover in construction is expected to continue to increase since the major infrastructure work for most of the cities and towns is still incomplete.

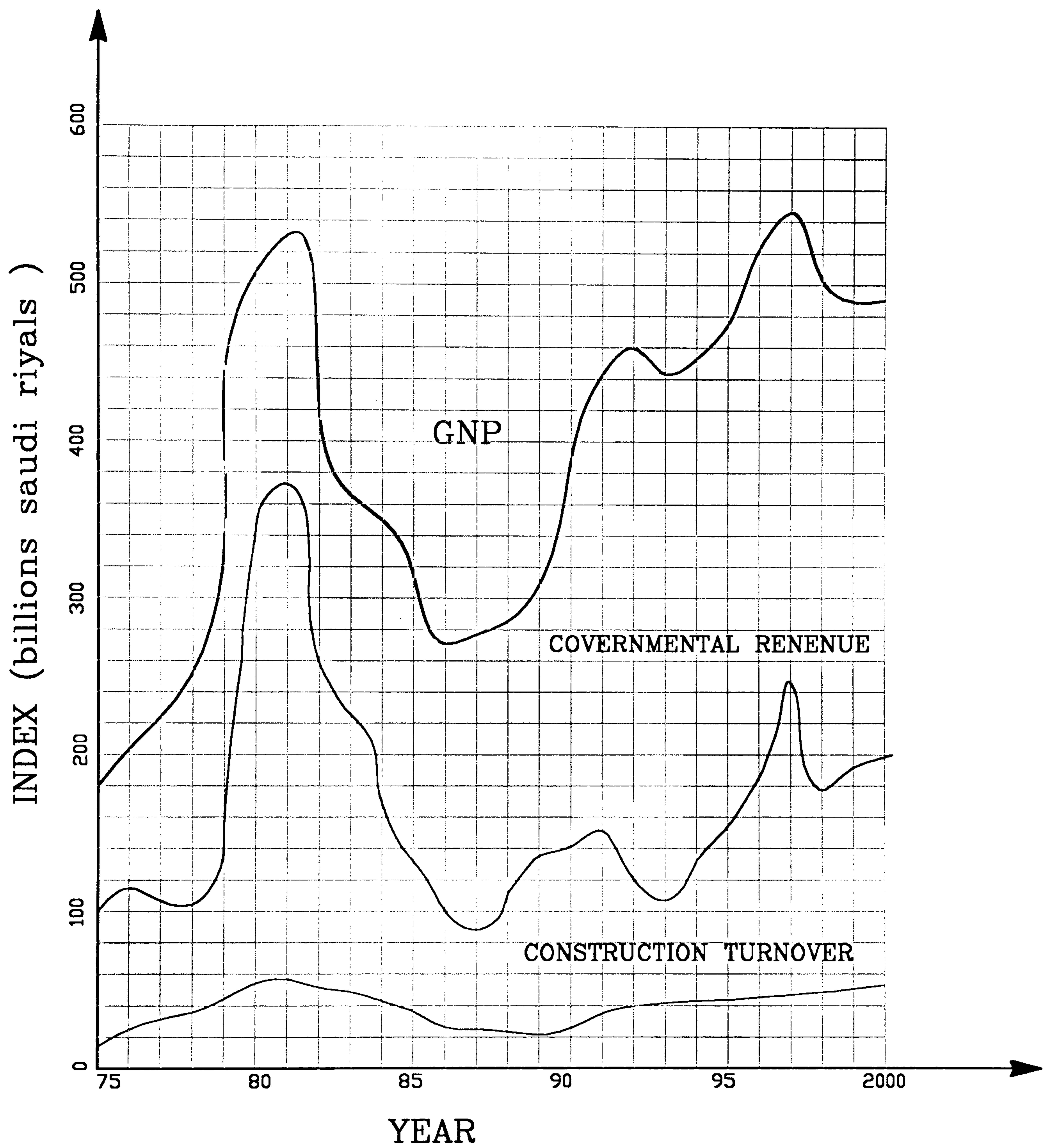


Fig. (4.1) : GNP AND THE CONSTRUCTION TURNOVER EVOLUTION FROM YEAR 1975 TO 2000

4.1.3 Contracting in the public and private sectors.

The construction sector in Saudi Arabia contains many construction organizations with different capabilities. The classification for an organization is one of the requirements of the pre-qualification for each organization seeking contracting.

More than 1900 classified construction organization is working with private and public sectors and more than 8500 unclassified contractors are working with the private sector since they are not allowed to work with the public sector and they can be considered as a contractors with weak capabilities.

Number of construction licenses issued from the Ministry of Municipalities and Rural Affairs (MOMRA) are illustrated in Table 4.1 where the majority of the licenses are for residential projects and housing, then industrial and commercial projects. The educational and health projects have the third level...etc.

TABLE 4.1 CONSTRUCTION LICENSES (SAMA, 2000)

| CONSTRUCTION TYPE | YEAR | | | |
|--------------------------------------|--------------|--------------|--------------|--------------|
| | 1996 | 1997 | 1998 | *1999 |
| Residential/Housing | 26374 | 23255 | 19816 | 13676 |
| Industrial or Commercial Projects | 1723 | 1288 | 1018 | 957 |
| Educational and Health projects | 878 | 645 | 543 | 363 |
| Social and Governmental projects | 69 | 91 | 76 | 43 |
| TOTAL LICENSES | 29044 | 25279 | 21453 | 15034 |

*** TILL END OF SEPTEMBER 1999**

The classification of contractors is the responsibility of the Ministry of Housing and Public Works through the “ Agency for Contractors Classification (ACC) ”.

In Saudi Arabia, the construction sector has almost 15.7% of the total working labors which is approximated at year 2000 to be 7,059,400 labors and 1,108,300 labors are for construction works. It is calculated that around 9% of the total working labors are Saudi citizens and the remaining 91% are imported labors from Far Eastern and Middle Eastern countries (SAMA, 2001).

Also, the new rules for managing the unemployment problem in Saudi Arabia states that 30% of the employees in any organization should be Saudis. This rule becomes effective in the year 2001.

In addition, due to the nature of the construction works and the Saudi costumes, the women participation in the construction industry as a construction labor is not preferable.

The local and foreign suppliers are playing a major part in the Saudi construction market since around 39% of the project value are going to the suppliers. Nowadays, most of the construction materials are provided locally and special materials or special equipment is imported from foreign countries.

A-Public sector contracting

ACC classified 1953 contractors (till year 2000) and are classified as shown in Table 4.2. The fifth grade contractors are around 74.2% of the total number of contractors and they are constructing small projects (in public sector) with less than SR 5 millions (£0.9 millions).

The fourth and third grades contain about 12.6% and 7.1% of the total number of contractors and they are allowed to get contracts with less than SR 15 and 50 millions respectively.

The second and first grades have about 4% and 2.1% of the total respectively and are allowed to get contracts with less than SR 200 millions for the second grades and more than SR 200 millions for the first grade.

The first three grades are the most important organizations that are going to be covered in this study since big part of the construction market in Saudi Arabia is given to those categories and it is expected they have a quality program.

The public sector has almost 86% of the total volume of the construction works meaning that it depends on the government expenditure (SAMA, 2001).

Entering into the different areas of tendering depends on both the grades of the classification and the resources that a contractor has (i.e. technical staff, plant, financial status, etc.).

TABLE 4.2:CONTRACTORS CLASSIFICATION IN SAUDI ARABIA(ACC,2000)

| Type Range (millions) | Grade | | | | | |
|--------------------------|-------|--------|-------|--------|-------|-------|
| | First | Second | Third | Fourth | Fifth | Total |
| | >200 | 200 | 50 | 15 | 5 | |
| Housing | 21 | 37 | 81 | 94 | 651 | 884 |
| Highway | 8 | 14 | 15 | 30 | 269 | 336 |
| Sanitary | - | - | 10 | 18 | 83 | 111 |
| Electronic | 3 | 3 | 4 | 7 | 42 | 59 |
| Dams | 1 | 5 | 1 | 30 | 8 | 45 |
| Seaport | 1 | 2 | 1 | 2 | 6 | 12 |
| Electro-mechanic | 4 | 18 | 25 | 60 | 384 | 491 |
| Industrial | 2 | - | 1 | 6 | 6 | 15 |
| Subtotal | 40 | 79 | 138 | 247 | 1449 | |
| % of contractors | 2.1 | 4 | 7.1 | 12.6 | 74.2 | |
| Total contractors | | | | | | 1953 |

A contract is awarded on the basis of public auction in which all eligible contractors may submit tenders and no limit applies to the number of those participating. Normally for a tender, the contractor is not expected to calculate its rates; these are included with the client's project documentation and a straight discount is offered on the client's total project estimate by the contractor. The discount should be applied to all the unit rates for payment purposes otherwise the contractor is excluded.

Currently in Saudi Arabia the most procurement systems used by public sector are:

- i- Quantity with unit price contract
- ii- Cost reimbursable contract
- iii- Two stage tendering contract

For example contract type (i) and (iii) are adjudicated using the following:

-For type (i) the tenders of contractors who have the appropriate classification grade for the work at hand are adjudicated on the basis of ' cheapest win '.

-For type (iii) the most appropriate tender is awarded the contract. It takes the form of a 2-stage analysis, the first stage technical and the second stage financial. The most appropriate technical offer will be adjudicated and later on cost.

In the government regulations for construction industry, it is allowed for the main contractor to subcontract 30% of the contract value provided that the government consent should be taken before subcontracting.

Also, foreign contractors can bid and get contracts in the Saudi construction market provided that 30% of the contract value is to be subcontracted for Saudi contractors (Ministry of Finance, 2001).

B- Private sector contracting

The private sector has almost 14% of the total volume of construction work (SAMA, 2000). Tendering for private sector work usually follows a pattern that would be based on project designs and bills of quantities. There is however no widely accepted standard forms of contract in the private sector. The basic principles are defined by

the civil code and contracts are invariably drawn up on an individual basis. The results are unsophisticated conditions of contract, and confrontation between the contract parties happens during the construction process.

The contract is always awarded on the basis of direct invitation in which all invited contractors may submit tenders and the lowest will win.

Currently in Saudi Arabia the most procurement systems are:

- i- Traditional method contract
- ii- Quantity with unit price contract
- iii- Design and build contract
- iv-Turnkey contract

4.1.4 Professional organizations and responsibilities for design and construction.

The role of the construction professionals in Saudi Arabia is extremely important as no civil engineering project irrespective of size can be carried out without a Civil Engineer, and no building project can be carried out without an Architect. The civil engineering and architectural professions are controlled by rules of the Ministry of Municipalities.

The local rules in Saudi Arabia state that all designs for public and private works must be overseen by the respective professional in the ministry of municipalities for an official approval.

Individual ‘Engineers’ can only practice the engineering profession in Saudi Arabia. The professional organizations or partnership has no juridical status and the full civil and professional responsibility fall on the individual.

In the design of public works, the responsibility for the design normally falls on a government official as project director to whom the “out side” consultants provide a technical assistance. In this case the government official takes responsibility for the project and the design consultants have a subsidiary responsibility.

Design consultant organizations have grown up in Saudi Arabia to respond to the task of providing technical assistance, usually of a multidisciplinary nature to the public clients. Before tendering for this work, the design consultant organizations must be registered at the ministry of commerce, and in turn categorized according to previous experience and resources.

The category awarded to the organization will determine the type of work for which the organization may tender and there are two types: consultant and specialized engineer for one profession.

More than 1200 licenses were given to individuals; 330 Licenses (28% of the total licenses) are for design consultants who can provide all various services of engineering and the remaining 870 licenses are for specialized engineers who can only provide one service (Ministry of Commerce, 2000).

For the design of private works, the appropriate organization has to be contracted by the client. The project design, bills of quantities, specifications and estimates have to conform to the requirements of the Saudi standards. Then the project design is presented to the authorities in the municipality for application of the necessary construction license; the professional fees for the same have to be paid.

4.2 Construction environment

It is necessary to understand the construction environment for determining whether the philosophy of TQM may be applicable. In this part of the study, a review for the environment in which the activities are performed. Also, a focus up on the organizational structure, execution of projects and the work breakdown for the Saudi construction industry are presented in details for better understanding of the major problems of quality.

4.2.1 Construction industry structure

The construction industry organizations consist of organizations involved in many types of works such as petrochemical, gas, power generation, oil, housing and others.

The structure of the Saudi construction industry has three layers, they are:

- 1- Client (owner): is the party investing in the project or “facility”.
- 2- Design consultant: has three functions to perform, they are:
 - i) Feasibility study.
 - ii) Planning, design, ...etc.
 - iii) Construction supervision.
- 3- Contractor: is the party constructing the project through providing the material from suppliers and by subcontracting parts of the project.

The structure of the Saudi construction industry is a traditional structure. The client can be a person, or an organization, and the last type “client organization” is going to be covered in this study assuming that government lies in this category.

Clients are classified based on the degree of sophistication that ranges from an organization with no engineering staff to an organization with in-house engineering and construction staff. Within these limits lie the majority of Saudi public organizations (Bubshit et. al, 1992).

The leader of the project team usually assigns responsibility, authority, liability, and contractual relationship.

4.2.2 Execution of projects

In general any project goes through stages from being an idea to the completion, and the stages are:

- 1- The client is normally the operating organization.
- 2- The client chooses a consultant to perform a feasibility study.
- 3- The client awards the contract to design the project to the same consultant or other one.
- 4- A number of contractors are pre-qualified to build the project and to submit their bids.
- 5- The client selects the contractor, with/without the help of the consultant, to construct the project and a consultant for supervision is hired to follow the

contractor. The hired consultant for supervision can be the consultant who made the design or another one.

- 6- The selected contractor then sub-lets parts of the project to subcontractors without the consent of the client unless specified in the project documents.

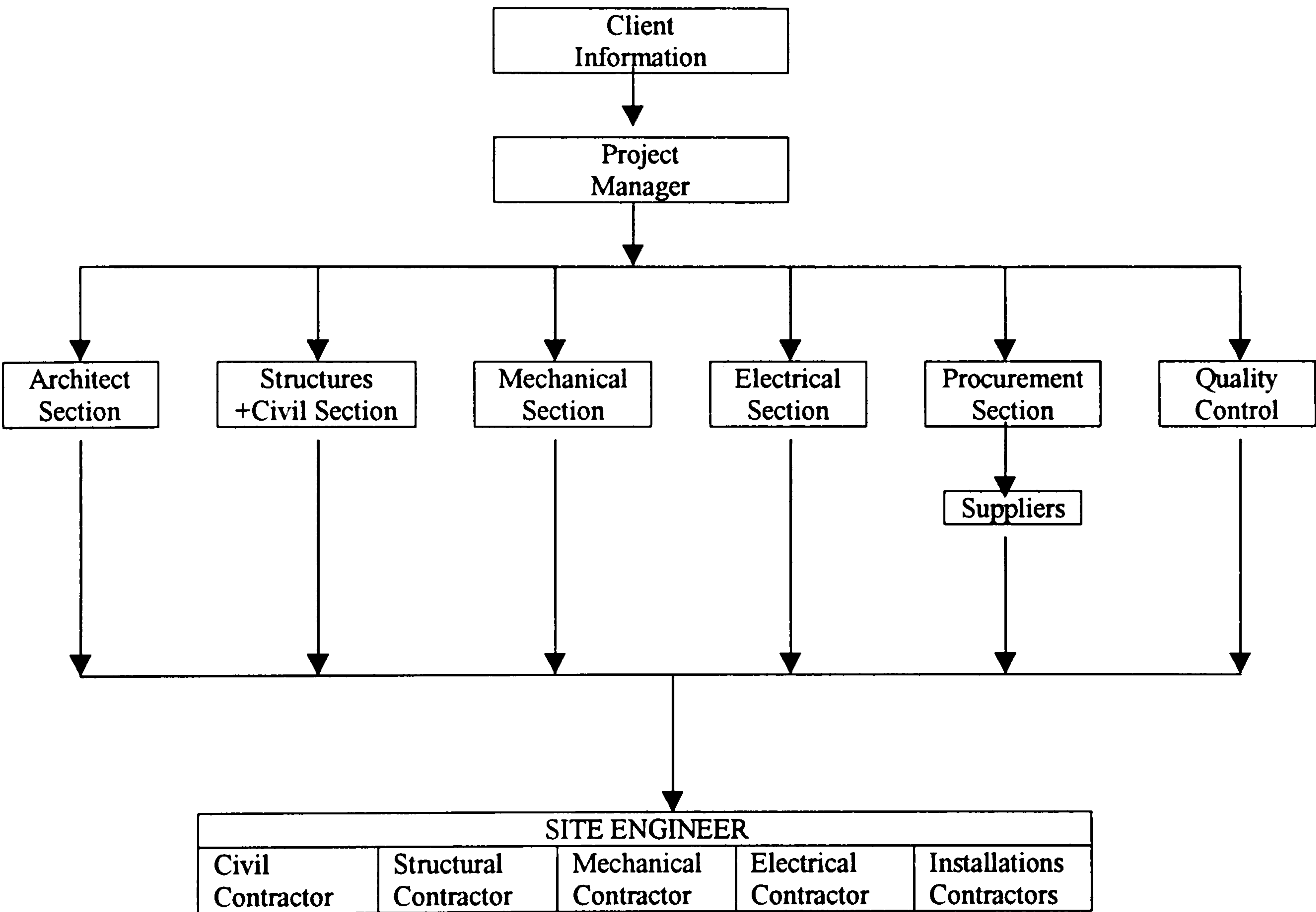


FIG. (4.2): ORGANIZATION OF CONSTRUCTION PROJECTS.

The flow of information in any projects starts when the client inputs the project scope through the project manager. The project manager then filters the information and introduces it into the relevant engineering disciplines in the organization. Figure 4.2 illustrates the flow of information.

The various engineering disciplines issue information, in the form of a design package, to the construction site. Then, the construction manager of the project has to consolidate the information into sub-contract packages for the execution.

The desired level of quality is decided at this stage through communicating the requirements that result from the client's objectives and expectations. Efficient client involvement will improve the total quality of constructed projects.

The client of a public project in Saudi Arabia has less influence in the design phase than in the planning and construction phases and this is due to the nature of work in public sector.

4.2.3 Construction site activities.

The construction activities that are undertaken on the site require resources to build the facility (labor, equipment and materials), and the work preparation skills for the site labor to perform the job.

The activities that are performed on a construction site are illustrated in Table 4.3. Also, it shows grouping for the main responsibilities of a site management team, and a detailed lists for the activities that are required to be addressed on a daily basis between the main contractors and subcontractors.

One of the roles of the main contractor is to co-ordinate between the subcontractors and to manage the site activities. Also, the main contractor has to develop the project schedule and to carry the responsibility for exchanging the information from the consultant to the labors or subcontractors and from the subcontractors to the consultant.

4.3 Quality culture in the Saudi construction industry organizations

Quality culture in an organization represents specific body of value concept pertaining quality in which a given organizational body believes (Khalid Bubshait, 2000).

TABLE(4.3): SITE ACTIVES

| SITE ACTIVITIES | | |
|---|---|--|
| Main Contractor | Activities | Sub-contractor |
| <ul style="list-style-type: none">- Construction Manager- Discipline Engineers- Planning Engineers | <u>1-PLANNING</u> <ul style="list-style-type: none">• Develop Schedules• Monitor progress• Release work fronts• Analyse Resources• Work Duration | <ul style="list-style-type: none">- Site manager.- Discipline Engineers- Planning Engineers |
| <ul style="list-style-type: none">- Construction Manager- Discipline Engineer.- QA/QC Inspectors | <u>2-TECHNICAL</u> <ul style="list-style-type: none">• Technical_ Training• Work preparation• Supervise Labor• Testing• Technical Queries• Document Control• QA/QC• Method Statements | <ul style="list-style-type: none">- Site Manager- Discipline Engineers.- QA/QC Inspectors. |
| <ul style="list-style-type: none">- Construction Manager- Material Controller. | <u>3-MATERIAL CONTROL</u> <ul style="list-style-type: none">• Material Logistics• Material Cert.• Material Queries | <ul style="list-style-type: none">- Site Manager.- Material Controller. |
| <ul style="list-style-type: none">- Construction Manager- Discipline Engineer.- Safety Inspector. | <u>4-SAFETY</u> <ul style="list-style-type: none">• Training• Permit Control• Site Discipline• H & S Legislation• Accidents / Incidents | <ul style="list-style-type: none">- Site Manager- Discipline Engineer.- Safety Inspector. |
| <ul style="list-style-type: none">- Construction Manager- Discipline Engineer.- Quantity Surveyor.- Project Manager. | <u>5-COMMERCIAL</u> <ul style="list-style-type: none">• Working Practices• Rates of Pay• Labor Agreements• Variation Orders• Contract Extensions• Premium Payments• Backcharges• Claims• Supervisory Ratios• Industrial. Relations | <ul style="list-style-type: none">- Site manager- Discipline Engineer.- Quantity Surveyor.- Project Manager |

Any organization intends to adopt TQM it should begin by making a supportive culture to lead to a successful achievement. Also organizations can assess periodically their prevailing culture and monitor the developing trends over the rating scale.

TABLE (4.4):THE EXISTING CLASSICAL AND QUALITY CULTURE
(Khalid Bubshait, 2000).

| | Existing Classical approach | Quality Culture approach |
|---|---------------------------------------|---|
| 1 | Product oriented. | Process oriented. |
| 2 | Little interest on training. | More concentration on education and training. |
| 3 | Corrective attitude. | Preventive attitude. |
| 4 | Blaming attitude. | Problem solving. |
| 5 | Cost reduction. | More market share. |
| 6 | Focus on standards or specifications. | Continuous improvement. |
| 7 | Hierarchical structure. | Flattened structure. |
| 8 | External control | Internalized control to individuals. |

The successful transformation to TQM requires a change in the organizational culture of an organization. The change task in organizational culture is considered the most complex step in TQM implementation effort. The first step in changing the organizational culture to quality culture would be to assess the current organizational culture using a suitable instrument. Then, the collected data can be compared with the TQM approach to identify the actual gaps that must be filled using an appropriate corrective action (Khalid Bubshait, 2000).

Some of the classical management approaches existing in the Saudi organizations, which need a corrective action to match TQM approach, is illustrated in detail in Table 4.4.

Many organization in the Saudi construction industry sector have started to adopt TQM and created a quality culture in their management system through a TQM consultants. But many organizations use a TQM model that is not developed specially for construction industry and as a result they may fail to reap the benefit of TQM. Also, the existing models may not match the organizational culture of the country. Therefore, there is a need for a TQM model with an appropriate self-assessment instrument designed for the Saudi construction industry organizations.

Self-assessment instrument is really needed to assess the current practices of TQM and to help organizations to identify and correct gaps in their performance during the TQM journey.

4.3.1 Quality of project Design and Construction

In Saudi Arabia, the large volume of construction projects has led giant, multi-national consultants and construction contractors to the local market and created intensive competition. Although quality systems are relatively new in Saudi Arabia, especially in the construction industry but the concept is receiving the utmost attention from large construction organizations who seek a competitive edge (Bubshait and Al-Atiq, 1999).

Quality systems involve internal and external aspects. An internal quality system covers activities for providing confidence to the management of an organization that the intended quality is being achieved. This is called a “ quality management system ”. An external quality system covers activities for inspiring confidence in the client that the supplier’s quality system will provide a product or services that satisfy the client’s quality requirements. This is called a “ quality assurance system ”.

The quality of project design and construction in Saudi Arabia is presented in details in the following sections.

A- Quality of project design

Currently within the construction industry in Saudi Arabia, there exists an underlying low regard for the general level of quality of project designs produced for public and private works.

The quality of designs, studies, and reports are improving in the consultant organizations through quality control activities on each project and if plans and specifications are more carefully reviewed, corrections can be made before the document are issued for bidding. Unfortunately in Saudi Arabia, this additional level of reviews and corrections adds time and costs to the design and this makes matters worse because the clients do not want to wait any longer or pay any more than they do already, i.e. more for less.

The general notes concerning project designs are:

- i)-The project designs for both public and private works are frequently presented with a poor level of detail, which leads later to quality problems of a technical nature as well as mistakes being made in evaluation of costs and program times for construction.
- ii)-The projects are prepared with a level of inter-professional collaboration which is below that required for the technological complexity of today's construction industry.

In many cases for public works projects the quality of the design is determined by the inadequate conditions set by the promoter.

Also, faults in the design lead to significant variations in the real cost of the works compared with the predicted cost at the time of the design.

B- Quality of construction projects

Quality assurance is important in the construction industry because there is risk involved in any project. A contractor's quality assurance system is essential in

preventing problems and the reoccurrence of problems in order to ensure consistent quality for the client.

An evaluation study for the quality system of 15 construction contractors in the eastern province in Saudi Arabia was performed against the ISO 9000 standard. It was found that the quality systems vary in complexity, ranging from an informal inspection and test system to a comprehensive system (Bubshait and Al-Atiq, 1999).

Also, the ISO 9000 clauses often compiled with, are those dealing with the followings:

- 1- Inspection and test status
- 2- Inspection and testing
- 3- Control of nonconformance product
- 4- Handling, storage, and preservation

Also, the clauses least compiled with, are the followings:

- 1- Design control
- 2- Internal auditing
- 3- Training
- 4- Statistical techniques

Of the 15 contractors, two are registered to the ISO 9002-1994 standard, four are planning to be registered in the near future, and three have hired external consultants to assist in the process of establishing formal quality system and preparing for registration. The remaining four contractors are interested in being registered but not in the near future.

CHAPTER 5

APPLICATIONS OF TQM WITHIN THE CONSTRUCTION INDUSTRY ORGANIZATIONS

5.1 Meaning of TQM to the construction industry organizations

The main parties in the construction industry are construction client organizations, consultant-design organizations, and construction organizations. The supply chain in the construction industry may be clients, consultants, contractors, subcontractors and suppliers. Each actor in the supply chain has its role to play. The owner perceives a need to invest in a building project. The owner employs consultants like architects and engineers to design the project. The main contractor is then selected to construct the project according to the design. The main contractor will employ many domestic subcontractors, plus other subcontractors named or nominated by the client to carry out the construction work. Suppliers will also be involved to supply the required materials, either to the main contractor who hands them to the subcontractor to fix and install, or directly to the subcontractor. The main supply chain in construction industry and the inter-relation is illustrated through Figure 5.1 where the client becomes a customer for the design consultant. Also, the design consultant becomes a supplier for the contractor and the contractor becomes a supplier for the client through providing the “facility”.

5.1.1 Meaning of TQM to Construction Clients

In the construction industry, construction clients are not the end user or end buyers but in fact they are a promoter. The significance of TQM for a construction client organization does not differ in comparison with the other type of organization where satisfying the customer through continuous improvement through procedures and methods that control the processes for producing the required facility. The client may be a private organization, a public department or a public organization where the final product is served to the public, individual, and or a private organization that looks to

construct and sell or rent a facility. In all cases, the client has to present the required facility for his customer in a good quality and a reasonable price.

The relation between the parties in construction starts when the client looks for a design consultant and a contractor for supplying the requirements. The client is responsible for dictating an accurate brief to the suppliers in order to stick with the specifications and avoid changes or the suppliers provide further information as required.

The effective communication between the client and the suppliers is one of the major reasons for the project success. The client needs to communicate with the suppliers if what is specified are not what the client wants. The situation becomes more effective when the client encourages the suppliers to interpret any questions in the client's mind.

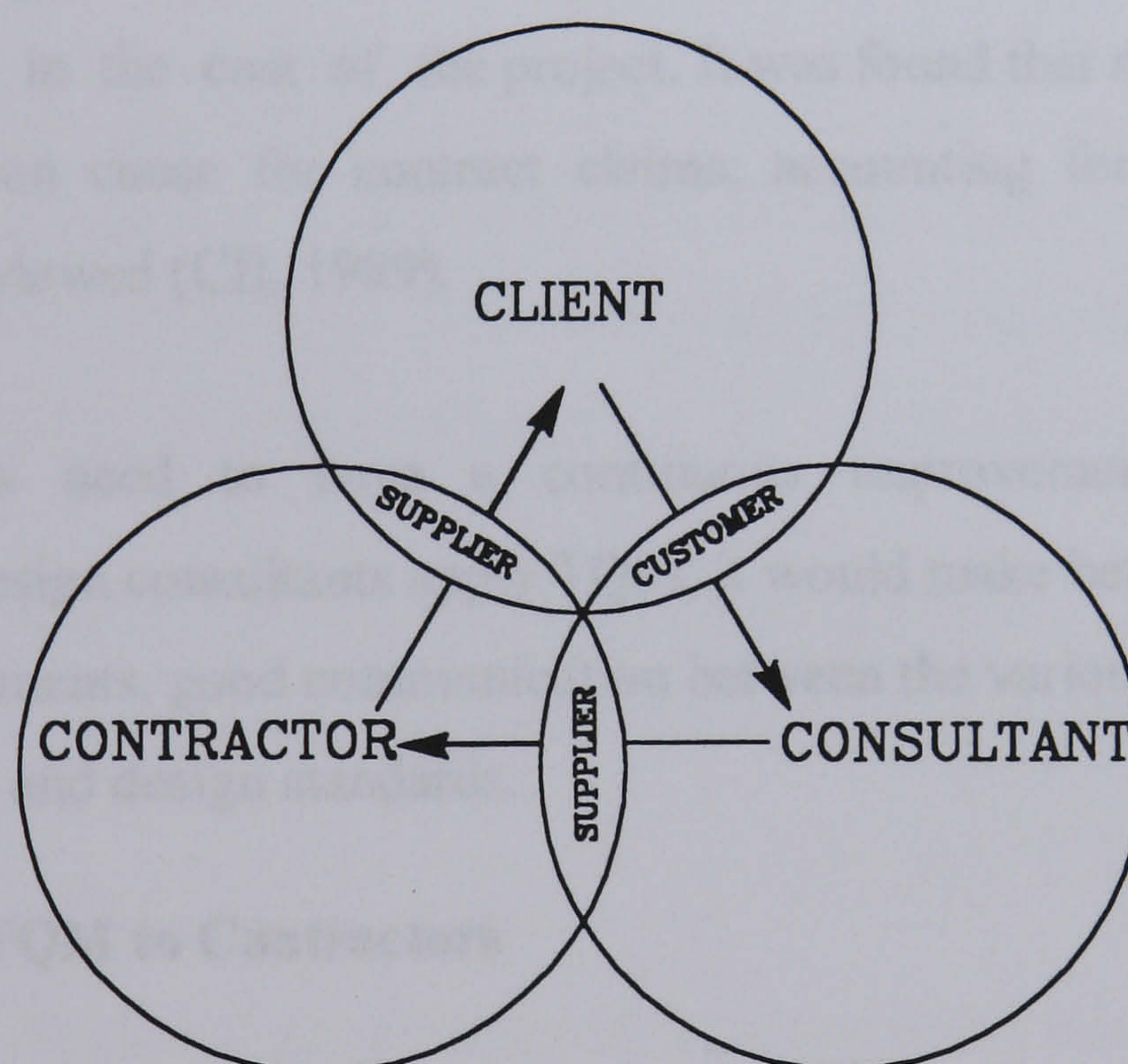


FIG.(5.1):SUPPLY CHAIN IN CONSTRUCTION INDUSTRY

5.1.2 Meaning of TQM to Design Consultants

For the TQM to be successful, all parties; clients, design consultants and contractors should adopt it. The principles of TQM are to satisfy the customer and to have continuous improvement. With respect to customer satisfaction, the objectives for the

design consultant depend on the arrangement of the contract. The design consultants should understand and satisfy the client 'project promoter' to produce a design which fulfills all the aesthetic, economic and financial requirements of the clients.

Also, the design consultants have to understand the contractor by using clear and ambiguous documents and proposals that are within the practical limits of the construction techniques. If the contract is 'turnkey' or 'design and build', the design consultant will be employed by the contractor which is simple to satisfy. But if the contract is 'traditional', the design consultant is far from the straightforward and has to satisfy both the client and the contractor.

With respect to the second principle of TQM 'continuous improvement' illustrated in chapter 2, the design consultant would appear to be in the position to make the biggest impact on savings in the cost of the project. It was found that design errors were the single most common cause for contract claims; accounting for 46% of the additive claims that were reviewed (CII, 1989).

Design consultants need to have a continuous improvement policy for better performance. If design consultants apply TQM, it would make better understanding for the client's requirements, good communication between the various designers, and right use for information and design standards.

5.1.3 Meaning of TQM to Contractors

In construction, TQM does not only concentrate on the removal of defects but also it searches for ways to improve the manner in which the work is executed and to develop new product features to satisfy the customers.

Contractors need to satisfy their customers and at the same time reduce costs. With the approach of TQM which might be used to accomplish the principles namely satisfying customers and improving the performance continuously, the contractor can get the following advantages (ECI, 1996):

- Satisfying external customers;
- Teamwork;

- Each person satisfying the internal customers;
- Partnership between organizations and customers;
- Employee involvement and development;
- Reducing cost;

5.2 TQM and the construction sites

The development of quality assurance in the 1980's has improved the quality and efficiency of the performance of contractors, subcontractors and material suppliers. There is an increase in competition in Saudi Arabia between local and foreign contractors especially in the private sector of the construction industry. Quality assurance becomes insufficient to insure success for subcontractors and material suppliers.

Improving the quality and service provided to clients need to adopt a TQM philosophy as an approach for continuous improvement. As well as adopting the TQM in attempt to give the organization a competitive edge. ISO 9000 becomes a pre-requisite to awarding contract in many sectors in Saudi Arabia such as the petrochemical sector ...etc.

TQM is mainly implemented by contractors in the head office and in particular on the related activities to continuous operations rather than activities that reflect project characteristics.

The construction activities at site for any project accounts for approximately 30% of the total project cost (Barrie, 1984). Also, the construction site reflects the characteristics of project more than in any stage during project execution. The characteristic of a project that are related to construction phase at site are:

- Unique scope of work.
- High customized output by the owner.
- Novel working conditions and practices.
- Low frequency cycles (around 2 years).
- Transient management team and work force.

Also, projects are executed at different locations and areas in the same country such as Saudi Arabia which has different soil characteristics ranging between loose sand and rock and rainy in the south and dry at north with humid air at the east and west areas.

Extending the TQM process to sites is an important element of the overall implementation of TQM. The construction organization “contractor” should implement the TQM at site when the organization’s internal implementation is well established at the head office to insure good performance results.

Achieving project quality at sites requires the commitment of all concerned with the construction process; the client and all the staff at sites, including site manager, supervisors, foremen, and other operatives.

5.2.1 Meaning of TQM to sub-contractors and material suppliers

Extension of the TQM process to material suppliers and sub-contractors is an important stage in the overall implementation of the TQM within the construction industry.

The term ‘supplier’ is going to be used through this research to represent the party that provides a service or product to another party in the supply chain. For instance, the subcontractor is a supplier of part or specific work of the project for the main contractor and the vendors or manufacturers are suppliers of materials for the main contractor and subcontractors.

Improving the performance in the construction industry is also required from subcontractors. The role of the subcontractors in the supply chain is through the main contractor who has an agreement with the client. There are several reasons for the main contractor to use subcontractors (Wong, 1999), they are:

- 1- A subcontractor possesses specialized technical, engineering, or construction skills.
- 2- The contractor’s in-house abilities are limited in a particular area.
- 3- A subcontractor can augment the contractor’s labor force at a lower cost by relieving the contractor of developing and maintaining an in-house capability.

The application of TQM to the main contractor will surely help in improving the performance. Since big part of the construction work is subcontracted out. Therefore, the message of TQM should also spread to all subcontractors and material suppliers in order to get quality performance in all the supply chain of the construction industry.

Figure 5.2 shows that the main contractor becomes ‘customer’ for the material suppliers and the main contractor becomes ‘customer’ for the subcontractor and at the same time the subcontractor becomes one of the ‘suppliers’ for the main contractor in the supply chain at construction site. Also, vendors, manufacturers...etc. become a ‘suppliers’ of the main contractor and subcontractors.

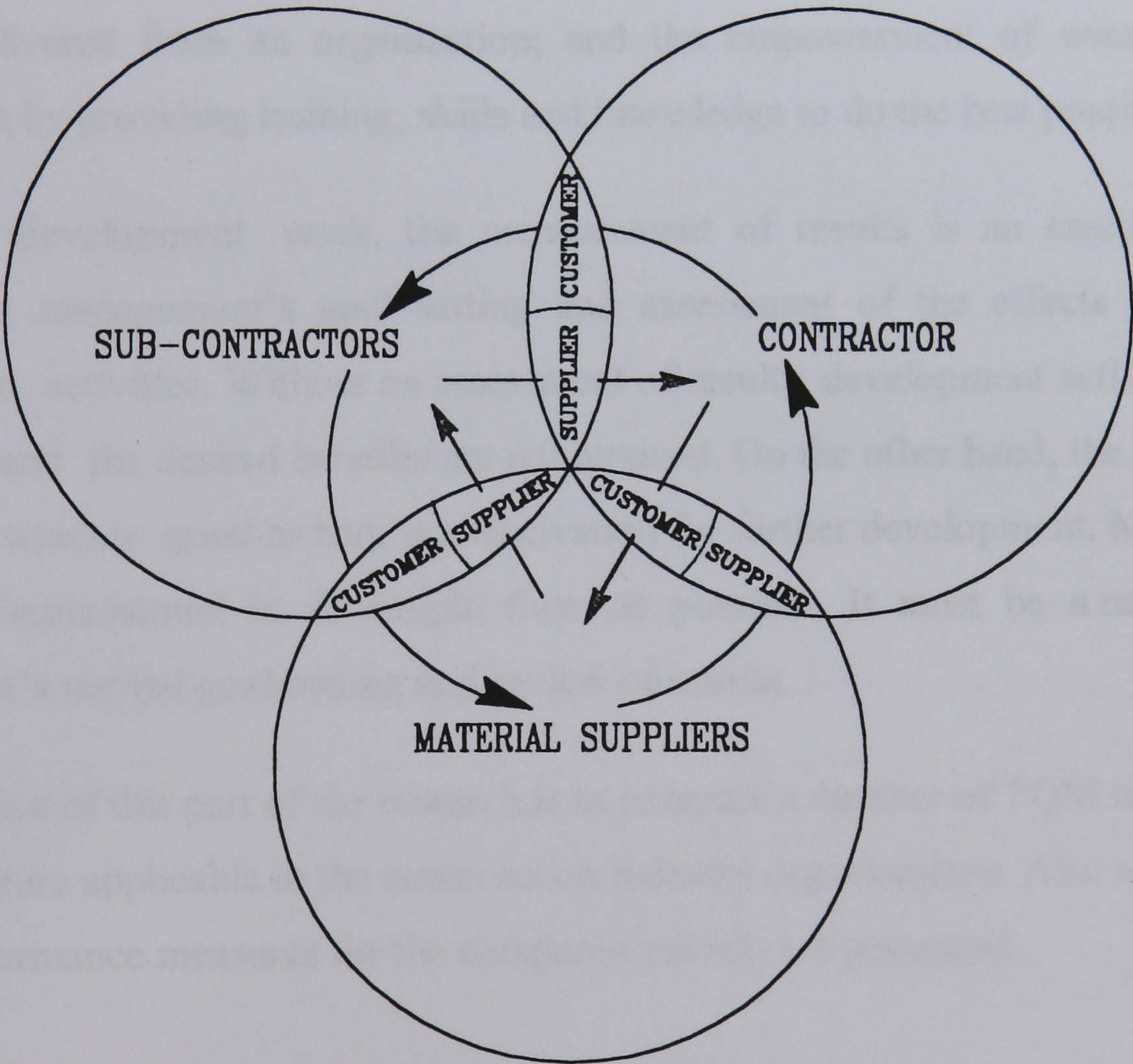


FIG.(5.2):SUPPLY CHAIN AT CONSTRUCTION SITE

The structure of the relationships between customers and suppliers should be systematically managed. The CII presented two basic approaches for evaluating suppliers. They are:

- 1- Individual suppliers are considered and evaluated for progressively higher status based on specific qualification requirements.
- 2- The organization begins with the existing suppliers base and reduces its numbers by 'evaluating out' all but those who meet the qualification standards.

5.3 Comparison study for the TQM models and measures used within the construction industry organizations

The application of TQM within the construction industry has improved the competition position of the construction industry organizations. In TQM: the client satisfaction is objective in every initiative; the business process improvement is continuous in the services delivered from an organization; and the empowerment of every one in the organization by providing training, skills and knowledge to do the best possible service.

In quality development work, the measurement of results is an essential part of organization management's goal setting and assessment of the effects of launched development activities. Without an assessment of results, development activities remain ill-defined and the desired benefits are not attained. On the other hand, the presentation of results, whether good or bad, is a motivation for further development. Measurement should be implemented in as simple form as possible. It must be a natural part of management's normal goal-setting and review of results.

The objective of this part of the research is to compare a number of TQM models found in the literature applicable to the construction industry organizations. Also a comparison for the performance measures for the compared models are presented.

5.3.1 Comparison between TQM models used within the construction industry

Different approaches have been developed which reflects the particular author's experience and background (Dale & Prapopoulos, 1995). Researchers, consultants, and

experts have proposed different frameworks in the field of TQM and the most common ones are reviewed as samples especially the most widely published and relevant ones.

The TQM models are categorized into three types these are: academic and construction institutes based models, award-based models, and Consultants/experts based models.

Basically, academic based frameworks are those models developed by academics and researchers such as Oakland (1993), TQMEX excellence, ECI (1996), CII (1994), Egypt model (1994), UK model and TQMNW (Nordic Way Criteria 1994).

Awards-based frameworks are those models given to organizations seeking to be recognized as a leaders in the TQM field such as Malcolm Baldrige National Quality Award (MBNQA), European Quality award (EQA), NASA Quality Award, Singapore Quality Award, and Australian Quality Award ...etc.

Consultants/experts based frameworks are those models derived from the opinion and judgment of consultants through experience while providing TQM consultation to organizations such as AT&T model (Lucent technologies), American general contractors (AGC) model, and HDR Inc. model in U.S.A.

i) Academic and Construction institutes-based frameworks

Different researchers have developed some form of implementation framework for adopting TQM. Oakland (1993) developed a TQM implementation plan consisting of a series of seven key steps. The first three steps are: gaining commitment to change, developing a shared mission and defining the measurable objectives. The other four steps are: developing the mission into its critical success factors, understanding the key critical processes and gaining ownership, breaking down the critical processes into sub-processes, activities and tasks and finally, monitoring and adjusting the process alignment in response to difficulties in the change process. Fifteen elements for TQM are proposed representing Oakland's framework that is used in this study as a base for comparison between TQM models. Also, Oakland incorporated a plan-do-check-act (PDCA) cycle for pursuing continuous and never-ending improvements.

A TQMEX or Total Quality Management Excellence model (Fung, 1996) for the construction industry has been developed based on sound TQM practices. TQMEX model consists of 10 elements, which are considered the main elements of TQM, and more attention is paid to “error prevention” during construction. There is no emphasis in this model on either process consistency or measures.

The researchers at the European Construction Institute (ECI, 1996) at Loughborough University in the UK have developed a TQM framework for improving the performance of the construction industry. The framework is intended to provide organizations, projects, sites or sections with a tool for determining their progress towards the achievement of Total Quality Management.

ECI model provides 12 key objectives (criteria) that need to be attained before any organization could be considered to be a TQM organization, and this model is considered suitable for small and large organizations and it has a step approach structure. The researcher could argue that if ECI model is easier for small organizations then there should be many small organizations, which have already been successful in their TQM efforts.

The Construction Industry Institutes (CII) in the U.S.A. (Oswald and Burati 1992) developed a model constitutes of 4-phases, exploration and commitment phase, planning and preparation phase, implementation phase, and sustaining phase. Each phase comprises quality activities that can improve performance. In this model, full time internal quality staffing is a necessary element and middle managers should be involved early. One of the pitfalls of this model is that, organizations should not try to do it alone without skilled external help and it needs to establish a coordination system for tracking team activities.

CII model is considered complex because there are many components interacting and dependent on each other and it is suitable for large construction organizations since full time internal quality staffing is needed.

Refaat H. A. (1998) in Egypt developed one of the academic models. This model consists of 16 criteria and the researcher believes that the model is suitable for the

traditional sectors of the construction industry, i.e. clients, consultants and contractors. The first element in order of priority, is the improvement of the design and planning in the pre-construction stage. The other important element is the improvement of the financial level and standard of living of employees. Another new element, which is a unique in this model, is “encouragement of innovation for simpler and more accurate work method”. The model does not contain measures for self-assessment or for performance.

Jawahanesan L.& price A. (1997) proposed the important tasks of the client’s representative (consultant) when TQM is implemented in construction projects. The task consists of 12 criteria and is presented in Table 5.1 under the name “UK model”. For achieving TQM in construction, there are other traditional construction management tasks, such as scheduling, preparation of budget and contract documents that the client’s representative should perform. The model is easy to understand and has a step approach structure but it does not contain any measures for performance assessment.

Also, there are other models such as China model, Taiwan model, and Professor Chase model (U.S.A) and all have a simple framework, step approach structure and do not contain measures for performance assessment or scoring system.

ii) Awards-based framework

The main purposes from quality awards used by many organizations in the last decade have been either as a tool to assess the progress of the organizations towards TQM implementation or to compete with other organizations in the market when the award is wanted.

Malcolm Baldrige National Quality award (MBNQA, 2001) contains 7 main criteria which are the principles of quality management in a clear language with a comprehensive framework suitable for assessing organization progress towards TQM. The main criteria are subdivided into 18 sub-criteria. This model is also called “Criteria for performance excellence”. The MBNQA criteria are grouped into four basic elements: Driver, System, Goal, and Measures of progress. The model has a ‘system approach structure’ where an overall picture is presented. High emphasis is given in this

model to customer perception and process consistency. Also, there is a guide for measures and scoring system capable of assessing the achievement towards TQM.

The European foundation for Quality Management (EFQM, 1999) was established in 1988 to manage the European Quality award (EQA). The model contains 9 main criteria subdivided into 32 sub-criteria. The principal objectives of EQA were similar to the MBNQA. The first five elements of the award are mainly concentrated on people and processes within an organization and are termed “enablers”. The remaining four are termed “results”. The model has a ‘system approach structure’ where an overall picture is presented but is considered to some extent difficult to understand.

Some writers (Ghobadian et al., 1997) have mentioned that MBNQA and EQA models as a framework for TQM implementation can be used and they suggested that these quality awards are particularly useful for small organizations. Ghobadian and Woo (1996) mentioned that “small companies lack knowledge of how to implement Total Quality and can not afford to engage expensive consultants”.

Hewitt (1997) described the difficulties faced by small businesses during application of self-assessment based on EQA model, Hewitt found that small organizations do not see the benefits in getting the award as compared to being certified to ISO 9000. Therefore, quality awards are not for beginners; awards are suitable for organizations who have already applied TQM and looking for better site in the market.

There are other quality awards in addition to MBNQA and EQA such as Australian quality award, Singapore quality award and NASA quality award and both are almost similar to MBNQA and EQA except more emphasis is given to “process consistency” in the NASA and Singapore quality awards.

There are also basic similarities in the assessment criteria between the awards since each of the quality awards aims to recognize successful TQM approaches based on customer focus in all functions in the organization that results in greater profitability and overall business achievements.

Yusof & Aspinwall (2000) mentioned that they tend to agree that Awards-based frameworks are more suitable for self-assessment as well as to gain recognition of a company's effort towards applying for an award.

There are another quality awards were not mentioned in table 5.1 such as Japanese Deming prize, Dubai quality award and Canada awards for business excellence and all are similar to some extent to MBNQA and EQA.

iii) Expert-based frameworks

All the quality gurus such as Deming, Crosby and Juran are or were experts at one stage in their career. The implementation approach for TQM developed by Deming (1986) consists of 14 points for management. His approach motivates top management to do changes in their business culture by adopting a quality improvement attitude for products, processes and services. Crosby (1980) presented his 14 steps for quality improvement program, which can build TQM in an organization. Juran (1993) gave 12 steps for organizations to follow for quality improvements.

There are many TQM models developed by experts (or consultants), for some construction organizations, these are:

-AT & T model (Lucent Technologies, 1988) is a systematic, fact-based approach to help organization to achieve improvement objectives and eliminate recurring business problems that affect customers, frustrate employees, or increase cost. The model consists of 7 criteria starting with leadership commitment and ends with focusing on employees and satisfaction. Also, AT&T developed a problem-solving technique, it starts with defining the reason for improvement then describes the current situation, analyzing data, plan and implement countermeasures, assess result, standardizing countermeasures, and ends with developing future plans. This model is considered simple and easy to understand, and has a 'system approach structure' where an overall picture is presented. This model has similarity to some extent with MBNQA.

-AGC or American General Contractors model developed by Chase (1993). The model consists of 12 criteria for continuous improvement. This model is derived mainly from

MBNQA criteria. Also, education for upper-level management is required for TQM success in construction organizations. Attentions for customers, employees and suppliers are part of the model. AGC thinks that by the CEO commitment, vision and mission statements, the organization can continue in quality improvement. Also, creating a steering committee is required in addition to the quality improvement team (teamwork). The steering committee consists of the president, vice president and department heads.

-HDR Inc. is a consulting Engineering organization at the United States. Culp and Smith (1993) developed a model with measures for implementing TQM. The model consists of 9 criteria and is applicable for engineering organizations. HDR has 1.500 persons, and 32 officers (engineering and architecture). The model is considered suitable for service organizations. It starts with orientation followed by commitment by management, customer & organizational assessment, key management training, planning of program, team selection, conduct project and ends with continuous improvement. This model has some similarity to the main elements of MBNQA and EQA, and it is different than other models since there is one step, which is “conduct project” to build success and learn how to implement the techniques effectively in the organization before expanding the process.

It is recommend initially focussing a few quality-improvement teams on a limited number of selected issues or projects, followed by phased expansion of the TQM process. TQM team members build self-confidence, communication skills, and conflict resolution skills.

-B & C model or Brown & Caldwell consultants in California (USA) launched a TQM initiative led by new management team, headed by new chairman and chief executive officer. Graves (1993) developed a model consisting of 8 criteria for improvements. There are two ways to improve quality: people and processes. Faulty processes cause about 85% of quality problems and people problems the remaining 15%. So B & C focuses first on improving the work process. The model has a step approach structure and is easy to understand but does not contain any measures for assessment as illustrated in Table 5.1.

TABLE(5.1) TQM MODELS USED WITHIN THE CONSTRUCTION INDUSTRY ORGANIZATIONS

| ORGANIZATIONS INVOLVED IN CONSTRUCTION INDUSTRY | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|-------------|-----------|-------------------|------------------|--------------------|--------------------|-----------|-----------|-----------|--------------|-------------|-------------|----------|----------------|-------------------|---------------|---|---|-------------|--|--|--|--|
| | TQM ELEMENTS (CRITERIA) | CLIENTS | | | | | | | | | | CONTRACTORS | | | | | | | | CONSULTANTS | | | | |
| | | MBNQA Model | EQA model | singapore Q.award | TQMEX excellence | Australian Q.award | AT&T lucent saudia | ECI model | AGC U.S.A | CII model | Taiwan model | China model | Egypt model | UK model | HDR INC. U.S.A | chase model U.S.A | B&C co. U.S.A | | | | | | | |
| 1 | understanding quality | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Commitment and leadership | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 3 | customer relationship | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 4 | supplier relationship | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | | | |
| 5 | design for Quality (standerds) | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | planning for Quality | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 7 | system design and contents(documents) | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | Quality system audit / Rivlew and self-assessment | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | |
| 9 | measurement of quality | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 10 | tools and techniques for quality Improvement | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 11 | organization for quality | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 12 | teamwork | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 13 | communication | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 14 | training | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 15 | focusing on employees and recognition | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |

5.3.2 Comparison between TQM measures used within the construction industry

The assessment of results is the driving force. But to measure improvements in quality and efficiency one must have a starting point from which to measure, and there must be active on-going effort to improve. The results of such measurements are only useful if they are followed up, and used in motivating and evaluating further improvement measures. The management loop: *PLAN – DO – CHECK – ACT* applies continuously.

The quality program is a necessary tool for organizing and controlling the process. An organization needs to measure its progress in many ways and places (Sjoholt et al. 1994):

- Within the various fields of the organization's activity.
- At the different levels of the organization's internal hierarchy.
- In relation to plans and aims that have descended the scale from the highest level to the individual employee.
- Over varying periods of time.
- In relation to each development project.

Also, the system of measurement must be carefully formulated and must be managed in a disciplined manner. Measures must meet the followings in order to add the intended value to the TQM process:

- Measurable.
- Significant to the organization, either as customer-focused measures or internal management indicators.
- Influenceable.
- Meaningful and appropriate to the team.
- Repeatable.
- Relatively accurate and sensitive.
- Timely.
- Worth the cost of performing them.

In addition to these criteria, the measurement system should not be considered the main or only element of a TQM implementation. It is one of the many interrelated processes of TQM.

To begin with, improvements are aimed at reducing non-conformities and waste. These are the areas that, in the start phase, will yield the greatest returns. With fewer deviations and errors the total productivity also increases mostly because one reduces the snowballing effect of such errors.

Also, measurements may begin with the assessment of failures at hand over. Later on, they can be expanded to the measurement of annual repairs under warranty for a project and some production-period indicators measuring quality such as the realization of intermediate goals subject to penalties. External nonconformity costs measured in economical terms are also a clear indicator of quality.

The following are some of the general basic measures of results:

- 1- Quality of service/work
- 2- Achievement of time-scales
- 3- Standard of communication
- 4- Employee satisfaction
- 5- Employee involvement
- 6- Training & development
- 7- Safety
- 8- Impact on society
- 9- Good practice
- 10- Target zero (defects)
- 11- Work won on value criteria
- 12- Waste efficiency
- 13- Risk management
- 14- Employee turnover
- 15- Profitability
- 16- Shareholder funds/market value
- 17- Earnings per share growth
- 18- Market shear
- 19- Accuracy
- 20- Productivity
- 21- Customer complaints
- 22- Employee absenteeism

- 23- Internal customer satisfaction
- 24- Site contribution
- 25- Cost of quality improvements

Indicators of job-site quality must be developed. Owner requirements will dominate; however, each party (main contractor, sub-contractors, material suppliers, and consultant) should develop their own indicators. Both administrative and field operations must be addressed. Indicators of project quality include (Federal et al. 1993):

- Shop drawing turnaround time.
- Change-order turnaround time.
- Submittal turnaround time.
- Job-site cleanliness and orderliness.
- Nonconformance report, punch lists.
- Rework costs.
- Recall and warranty work.
- Job-site safety.

The internal assessment or internal self-assessment is important for each organization to assess its own TQM level. In general, the quality self-assessment process will demand considerable time and attention, and therefore the whole process has to be linked and integrated into the normal existing, planning and review process.

The assessment is based on three evaluation dimensions: (1) Approach, (2) Deployment, and (3) Results. The “Approach” refers to how the item requirements or method used are addressed. The “Deployment” refers to the extent to which the “Approach” is applied. The “Results” refers to outcomes in achieving the purposes and objectives of the organization.

All the criteria of TQM can be assessed using self-assessment statements to show the method of address or the extent of applying of each criterion and then the level of achieving TQM can be known.

The term “Results” refers to outcomes achieved by an organization. Results can be assessed on the basis of current performance.

The term “Performance” refers to output results obtained from processes, products, and services that permit assessment and comparison relative to goals, standards, past results and other organizations. Performance is mainly three types: (1) Customer-focused, including key product and service performance, (2) Financial and market place performance; and (3) Operational performance.

The followings are the measures found in the literature that are used within the construction industry. The measures are categorized as per the organization type within the construction industry.

i) Client organizations

Different models have been presented in this study and in this part, the performance measures or/and self-assessment statements for each model will be compared with other model’s measures.

MBNQA model has 29 assessment areas starting from assessing leadership and ending at focusing on employees and recognition. One element of the model has 45% of the weight of the assessment that is “ Business results” which means more concentration is given to this element in MBNQA model. The model contains scoring system consisting of 1000 points and guideline for assigning scores. The scoring guideline is divided into two assessment dimensions: (1) Approach-Deployment, and (2) Results.

EQA model contains 32 assessment areas. EQA has some similarity with MBNQA where the scoring system consists of 1000 points. Enablers and results are each valued at 500 points. The difference between EQA and MBNQA is that, in EQA more assessment statements are given to leadership, measurement of quality and organization for quality. The self-assessment of EQA and MBNQA models is considered suitable for assessing all types of organizations.

NASA, Singapore and Australian quality awards all have assessment areas and scoring system similar to some extent to MBNQA.

ii) Design Consultant organizations

The only model with performance measures found in the literature for design consultants is the “HDR inc.” in U.S.A where there are 28 measures for performance and it can be used for design consultant organizations. HDR has developed two measurements: short-term measurements and long-term measurements.

It is recommended that one should start with one project and build successes, and learn how to implement the techniques effectively in the organization before expanding the process (Culp et al. 1993).

The researcher urges that by implementing TQM, design consultant organizations can improve customer and employee satisfaction, and establish an environment to constantly improve quality.

iii) Construction organizations

Some models used by contractors such as MCG, ECI, CII, Singapore quality award, TQMNW, and Australian quality award are different and can be used for large or medium organizations.

Robertson (1997) described TQM measures for one of the construction organizations in the UK. MCG (Morrison Construction Group) at the UK has introduced 21 performance measures to provide pointers to where improvements in the business were required. In this model, more attention is paid to the ‘measurement of quality’ to show the overall progress in the business. The researcher urges that MCG measures are convenient to small and medium contractors who have already applied quality program.

ECI Measurement Matrix provides contractors only with a tool for assessing the organization’s TQM level and the extent of progress in each criterion towards the achievement of TQM. Each criterion of the twelve key objectives has six levels of attainment ranging from 0 to 5 to show the extent to which the approach is applied.

The management understanding scale for TQM developed by ECI ranges from 'none' for score starting from 0 to 11, 'uncertainty' from score 12 to 24, 'awakening' from score 25 to 32, 'enlightenment' from score 33 to 44, 'empowerment' from score 45 to 54, 'wisdom' from score 55 to 60. ECI developed an achievement assessment graph that is based on Crosby maturity grid, for easiness in assessing the extent of awareness of TQM in the construction industry organizations.

The CII performance measures are the experience and opinion of several organizations that have developed effective measurement system. It consists of three definitions: measures, metrics and measurements. These terms can be defined as:

- Measure is a standard for determining extent, dimensions and etc.
- Metric is a measurable outcome indicating degree of success in achieving quality objective.
- Measurement is a quantified statement of extent.

Also, the CII performance measures are different than ECI measures in the structuring system where most of CII measures assess the operational performance in addition to measuring the overall performance but ECI measurement matrix assesses only the overall level of TQM. The CII performance measures are effective and give good indicator for the organization performance and can be used as a tool by the quality managers for continuous monitoring of quality-related performance. Also, CII measures can help the decision-makers to identify those areas of quality management where the improvements should be made.

There is similarity between MCG measures and CII measures in some of the basic measures that are related to construction but CII measures are more and almost double in the number. The CII model does not have a scoring system for assessment but ECI has a scoring system. Also, the CII model contains 13 measures to assess the performance of supplier organizations and those measures can be used to assess the performance of sub-contractors and material suppliers as shown in Table 5.2.

Singapore quality award and Australian quality award are similar to some extent to MBNQA and EQA and they are used by some of the construction organizations in Singapore and Australia.

TABLE(5.2) : TQM MEASURES USED WITHIN THE CONSTRUCTION INDUSTRY

| TQM ELEMENTS (CRITERIA) | | SELECTED ORGANIZATIONS INVOLVED IN CONSTRUCTION INDUSTRY | | | | | | | | | | | |
|----------------------------|--|--|-----|-----------------|-----------|-----|-----|---------------------------|--------|-----------------------|-------------------|----|---|
| | | CLIENTS | | | | | | CONTRACTORS + CONSULTANTS | | | | | |
| | | MBNQA | EQA | NASA Q.award | MCG UK | ECI | C// | singapore Q.award | TQ.MNW | Australian Q.award | HDR inc. U.S.A | | |
| 1 | understanding Quality | | | | | | | | | | ✓ | 1 | |
| 2 | Commitment and leadership | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 3 | ✓ |
| 3 | customer relationship | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 4 | ✓ |
| 4 | supplier relationship | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | |
| 5 | Design for Quality | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | |
| 6 | Planning for quality | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2 | ✓ |
| 7 | System Design and contents | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | | | |
| 8 | Quality system audit/ review and self-assessment | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | 8 | ✓ |
| 9 | measurement of Quality | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 4 | ✓ |
| 10 | Tools and Techniques | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | 2 | |
| 11 | Organization for Quality | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ |
| 12 | Teamwork | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2 | ✓ |
| 13 | Communication | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | 2 | |
| 14 | Training | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 2 | ✓ |
| 15 | Focusing on employees and recognition | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | 1 | |
| sum | | 29 | 32 | 15 | 21 | 12 | 47 | 25 | 41 | 22 | | 28 | |

Sjoholt and Lakka (19994) provide TQMNW model or “Total Quality Management Nordic Way” has one of the systems for measuring TQM in construction. It has two main characteristics. First, it contains three assessment forms: assessment for the entire organization, assessment for a construction projects and assessment for a construction sites. Second, it has a measurement system for assessing the organization performance.

The self-assessment tool used by TQMNW is based on MBNQA with some modification to match construction requirements.

A scoring system of TQMNW is suggested for a sets a, b and c in the way quality award do, with a total of 1,000 points to assign. Instructions for TQMNW criteria is provided to show the level for mode of operation (m.o.); zero for “no specific m.o.”, 25% for “m.o. is not systematic and in limited use”, 50% for “systematic m.o. widely used”, 75% for “m.o. have yielded good results”, and 100% for “m.o. has spread company-wide”.

TQMNW has some similarity to ECI measurement matrix in the assessment of TQM level, and also, it is similar to some extent with the CII model concerning the measures of operational performance.

5.3.3 Summary of comparison

The comparison presented in section 5.3.1 and 5.3.2 illustrates in details the origin, the content, the unique features and the characteristics of each TQM model. But for more comparison, the main objectives in TQM models should be fulfilled before selecting the most appropriate model. The objectives fulfillment of TQM models such as customer perception, process consistency, continuous improvement, easiness to understanding and updating, and guide to measures and scoring system are illustrated in Table 5.3.

The result of comparison showed that MBNQA is the most appropriate TQM model for fulfilling the objectives illustrated in Table 5.3. The researcher argues that MBNQA model is the most appropriate model for the construction industry organizations among the studied models since it fulfills most of the objectives.

TABLE(5.3):OBJECTIVES FULFILLMENT OF TQM MODELS

| MODEL NAME | | CUSTOMER PERCEPTION | PROCESS CONSISTENCY | CONTINUOUS IMPROVEMENT | EASINESS TO UNDERSTANDING AND UPDATING | GUIDE TO MEASURES AND SCORING SYSTEM |
|------------|-------------------|---------------------|---------------------|------------------------|--|--------------------------------------|
| 1 | MBNQA | ✓ | ✓ | ✓ | ✓ | ✓✓ |
| 2 | EQA | ✓ | ✓ | ✓ | x | ✓ |
| 3 | singapore Q AWARD | ✓ | ✓✓ | ✓ | ✓ | ✓ |
| 4 | TQMEX excellence | ✓ | x | ✓ | ✓ | x |
| 5 | Australian Q.A | ✓ | ✓ | ✓ | ✓ | ✓ |
| 6 | AT&T(Luecent T.) | ✓ | ✓ | ✓ | ✓ | ✓x |
| 7 | ECI | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8 | CII | ✓ | ✓ | ✓ | x | ✓x |
| 9 | AGC U.S.A | ✓ | ✓ | ✓ | ✓ | ✓ |
| 10 | TAIWAN MODEL | ✓ | ✓ | x | x | x |
| 11 | EGYPT MODEL | ✓ | ✓ | ✓ | ✓ | x |
| 12 | CHINA MODEL | x | ✓ | ✓ | ✓ | x |
| 13 | UK.MODEL | ✓ | ✓ | ✓ | ✓ | x |
| 14 | HDR INC.(U.S.A.) | ✓ | ✓ | ✓ | ✓ | ✓x |
| 15 | CHASE MODEL | ✓ | ✓ | ✓ | ✓ | x |
| 16 | B&C CO.(U.S.A) | ✓ | ✓ | x | ✓ | x |

notes:

- ✓ there is emphasis
- x there is no emphasis
- ✓✓ particularly more emphasis
- ✓x there is measures but there is no scoring system

CHAPTER 6

TQM GENERIC MODEL AND SELF-ASSESSMENT INSTRUMENT FOR THE SAUDI CONSTRUCTION INDUSTRY ORGANIZATIONS

The Saudi construction industry, as mentioned in Chapter 4, is similar to other construction industries in the world except some differences referring to the Saudi organizational culture.

Therefore, TQM approach is generally applicable within the Saudi construction industry and as a result, the Saudi construction industry will satisfy the followings:

- Satisfaction for customers.
- Improvement for the efficiency and effectiveness of the organizations.
- Improving the ability of competition with foreign organizations working in construction especially under WTO rules in the new millennium.

The researcher argues that there is a necessity for a generic TQM model for the Saudi construction industry organizations that takes in consideration the Saudi organizational culture and the requirements of construction industry. Also, there is a clear need to assess TQM practices through a self-assessment instrument as a key part of the TQM implementation strategy.

6.1 TQM generic model for the Saudi construction industry

Many organizations in the Saudi construction industry sector have started to adopt TQM and created a quality culture in their management system through a TQM consultants. They use some of the existing TQM models that are not developed specially for the construction industry organizations. Also, the existing models may not match the organizational culture of the country and this may cause conflict with the existing culture and then failure in TQM implementation.

The successful transformation to TQM requires a change in the organizational culture of an organization. The first step in changing the organizational culture to quality culture would be to assess the current organizational culture using a suitable instrument. Then, the collected data can be compared with the TQM approach to identify the actual gaps that must be filled using an appropriate corrective action. Self-assessment instrument is helping organizations to identify and correct gaps in their performance. Also, organizations do benefit from a quick measure of their current quality performance without having to go through a formal quality award application.

The definition for quality is much broader than the traditional definition that primarily addresses the 'grade' of construction workmanship, equipment, and materials. Once work with improvements is underway, the measures can be extended to include new products and processes, and in addition to analyze the organization as a whole in the light of the concept of TQM. Measurements, as mentioned in Chapter 5, may begin with the assessment of failures at hand over and later on they can be expanded to the measurement of annual repairs under warranty and external nonconformity costs.

The organizations working in construction industry must exert an extensive up-front effort in scope definition and preplanning. A project team should be formed as early in the project as possible. The team should include members from all phases of the project. It generally consists of a project manager, person from all engineering disciplines, a construction representative, a quality engineer and a procurement manager. The teams are cross-functional and effective at identifying and minimizing potential problems.

The TQM team must measure over a specific period of time to establish a base line before making changes. The changes can then be made and another set of data collected to compare with the base line to evaluate the effects of the changes

The measured variables such as accuracy, productivity, efficiency, and timeliness are the main variables that TQM team should evaluate when assessing processes. But all these variables were not taken in consideration since one of the objectives in this research is to assess the overall quality performance of the organization.

Development of TQM generic model for the Saudi construction industry

The generic model has its basic elements from Malcolm Baldrige National Quality Award (MBNQA) which was described in Chapter 5 as the most suitable model that fulfills the requirements of TQM (see Table 5.3). The MBNQA was chosen for developing a generic model for the Saudi construction industry organizations because of the following reasons:

- Contains most of the principal TQM elements.
- Is composed of 29 assessment areas for the sub-criteria.
- Is used in Saudi Arabia by many organizations with different industries.
- Has been repeatedly adopted by a team of experts to reflect the current thinking of TQM.
- Is not limited to a single quality perspective but a diversity of viewpoints.
- Is easy to understand and update.
- Contains validated criteria and sub-criteria.

Also, another TQM model, presented in Chapter 5, was partially considered during developing the TQM generic model. One assessment area “independent certification for quality management system” that in ECI model was added as an assessment area in the modified MBNQA underneath the sixth criterion. Also, the ECI achievement assessment graph was considered for developing an achievement assessment graph for the generic model.

Few models were found containing some similarity to MBNQA and other models were found not suitable for the construction industry organizations. Other models were not considered for many reasons such as the presence of weakness in the model, complexity, or insufficient criteria.

MBNQA was found the most appropriate model among the studied TQM models for the reasons mentioned above. MBNQA is well known for many organizations in Saudi Arabia and it is recommended for application by TQM consultants as one of the TQM models. The researcher argues that adoption of MBNQA by TQM consultants in Saudi Arabia supports the selection of this model by the researcher among other models.

The chosen model “ MBNQA “ has some deficiencies that need addition and modification. The addition and modification for the sub-criteria of MBNQA were introduced to make the model matches the organizational culture and the requirements of the construction industry in Saudi Arabia that mentioned in chapter 4. Also, the role of suppliers and in addition to the relationship with partners in the business performance should be activated and clarified as main sub-criteria. The role of client, design consultant, contractor, material suppliers and sub-contractors will appear as a “ suppliers” since they are both providing product or service as illustrated in chapter 5.

The followings are the recommended additions and modifications to the chosen MBNQA to suit the construction industry in Saudi Arabia:

a) The required additions to the chosen MBNQA either as a sub-criteria or assessment areas:

- 1- Employees saudization
- 2- Independent certification of quality management system
- 3- Management of supplier & partnering processes
- 4- Supplier & partnering results

b) The suggested modification for the chosen MBNQA:

- 1- Scoring system
- 2- Progress evaluation guideline

Addition and modification processes

The detailed steps used through the addition and modification processes are presented as follows:

- 1-One assessment area for the sub-criterion “Public responsibility and citizenship” is added to match the objectives of the Saudi public and private sectors towards the “saudization of employees” as per the local rules that states 30% of employees in any organizations should be Saudis as mentioned in chapter 4. The researcher believes that the quality of work is going to improve as a result of saudizing the employees since the multi-cultural impact of foreign employees will decrease. In addition to, providing the Saudi market by trained

employees through investment in training and education. The organizations in Saudi Arabia can provide the Saudi labor market by a continuous and sufficient number of trainees.

The proposed assessment area for the sub-criterion “Public responsibility and Citizenship” is:

- *Employees saudization.*

2- The main criterion “process management” needs two additions to cope with the construction industry activities. The two additions are:

a-One assessment area has to be added to the sub-criterion “product and service processes” to increase the emphasis towards quality of product and service. The added assessment area is related to the quality management system (QMS) and it will give more emphasis for quality of product and service in the construction industry business.

The proposed assessment area is:

-*Independent certification of quality management system.*

b-One sub-criterion, very important for the business of construction, needs to be strengthened to activate the role of suppliers & partners in the business. The role of suppliers in addition to the relationship with partners should appear as a sub-criterion. The role of client, design consultant, contractor, material suppliers and sub-contractors will appear as a “suppliers” since they are both providing product or service. The proposed sub-criterion is: “Management of supplier & partnering processes”.

Also, an assessment area should be added to assess the proposed sub-criterion and it should appear as follows:

-*Management of supplier & partnering processes.*

3- The last addition is in the seventh criteria where the sub-criterion “organizational effectiveness results” needs another assessment area for the

added sub-criterion in item 2 (b). The proposed assessment area will assess and show the results that coming from suppliers & partners activities within construction industry. The added assessment area is:

- *Supplier & partnering results.*

4- Two main criteria were considered very critical and need more emphasis in the business of construction. These include Customer and market focus, and Human resource management. The modification for those two criteria will be as follows:

a-Customer and market focus: More attention should be given to the criterion because it has a primary importance in TQM. The criterion score needs restudying to see the actual weight.

b-Human resource management: the Saudi workforce as mentioned in Chapter 4 is a multinational workforce and in this case is more challenging where people from different countries with different cultures have to achieve one goal that is “ quality ”. As a result, some of the Saudi organizations do not pay enough attention for training and education since most of the employees are a multi-culture and have two years contract and they may leave before. Planting the TQM culture and implementing TQM in such environment needs special consideration through designing programs for training and education for preparing employees for the required quality culture. This step will find success and acceptance from the top management when the Saudization process gets its place as part of the quality culture of the organizations. Therefore, the researcher argues that the total scoring system must be studied again based on the exact status of TQM in Saudi Arabia.

The developed TQM generic model below consists of seven criteria, nineteen sub-criteria and thirty-three assessment areas. It provides the construction industry organizations with a framework as a guideline for TQM implementation. Therefore, one sub-criterion and four assessment areas were added to the chosen MBNQA model in addition to the required modification for the existing scoring system and the progress evaluation guideline.

TABEL(6.1): THE DEVELOPED TQM GENERIC MODEL

| TQM generic model for Saudi construction industry | | | |
|---|--|---|--|
| CRIT. | SUB-CRITERIA | ASSESSMENT AREA | |
| (7) Business results | 7.4- Organizational effectiveness results | a. Operational performance results b. Suppliers and partnering results c. Public responsibilities & citizenship | |
| | 7.3- Human resource results | a. Human resource results | |
| | 7.2- Financial and market results | a. Financial and market results | |
| | 7.1- Customer-focused results | a. Customer-focused results b. Product and service results | |
| (6) PROCESS MANAGEMENT | 6.4- Support processes | a. Support processes | |
| | 6.3- Business processes | a. Business processes | |
| | 6.2- Management of supplier & partnering processes | a. Management of supplier and partnering processes | |
| | 6.1- Product and service processes | a. Design processes b. Production/delivery processes c. Independent certification of QMS | |
| (5) HUMAN RESOURCE FOCUS | 5.3- Employee well-being and satisfaction | a. Work environment b. Employee support and satisfaction | |
| | 5.2- Employee education training and development | a. Employee education, training and development | |
| | 5.1- Work systems | a. Work systems | |
| (4) INFORMATION AND ANALYSIS | 4.2- Information and management | a. Data availability b. Hardware and software quality | |
| | 4.1- Measurement and analysis of performance | a. Performance measurement b. Performance analysis and use of tools | |
| (3) CUSTOMER AND MARKET FOCUS | 3.2- Customer relationships and stisfaction | a. Customer relationships b. Customer satisfaction determination | |
| | 3.1- Customer and market knowledge | a. Customer and Market knowledge | |
| (2) STRATEGIC PLANNING | 2.2- Strategy deployment | a. Action plan development and deployment b. Performance projection | |
| | 2.1- Strategy development | a. Strategy development pocesses b. Strategic objectives | |
| (1) LEADERSHIP | 1.2- Public responsibility and citizenship | a. Responsibilities to the public b. Support of key communities c. Employees saudization | |
| | 1.1 - Organizational leadership | a. Senior leadership directions b. Organizational performance review | |

The developed TQM generic model provides not only a comprehensive criterion listing but also a wide spectrum. It contains many aspects that are very specific to the Saudi construction industry environment. It provides the Saudi construction industry organizations plus points for a more comprehensive, indicative, reliable and customized system for managing the business. The developed TQM generic model for the Saudi construction industry organizations is shown in Table 6.1.

The developed TQM generic model consists of 33 assessment areas forming the base for any self-assessment process. The TQM model is developed to cope with the Saudi construction industry sector. As a result, the researcher believes that the developed TQM generic model has the ability to guide the construction industry business in Saudi Arabia to a better performance.

6.2 Development of self-assessment instrument to measure quality Performance

The review of self-assessment instruments developed over the past few years has proven that organizations do benefit from a quick measure of their current quality performance without having to go through actual application for the TQM award. Organizations in other industries are increasingly using self-assessment instrument to drive continuous improvement and direct the TQM journey in moving the organizations towards business excellence. Therefore, self-assessment instrument could be developed for the construction industry organizations using the “developed TQM generic model”.

The criteria in the developed TQM generic model provide a comprehensive performance assessment of various areas in an organization. The TQM generic model could regularly be used to benchmark the current quality performance of organizations and identify areas of improvement.

Also, the developed TQM generic model will be the base for developing self-assessment instrument for the Saudi construction industry organizations. It can be facilitated for wider use through developing self-assessment instrument in the form of a survey-based questionnaire to measure the essential elements in each criterion in the developed TQM model.

Managing such self-assessment survey through a TQM consultant will assist in setting up benchmarking information within and outside the construction industry. Benchmarking could lead to better improvement for construction industry organizations.

It is clear that self-assessment instrument is an issue for management and business improvement. The main important reasons for developing self-assessment instrument for the Saudi construction industry organizations are the followings:

- 1- Promote awareness of quality
- 2- Looking for opportunities for improvement
- 3- Managing and directing the improvement process
- 4- Measuring performance of processes
- 5- Linking quality with the strategic planning process

The quality self-assessment process demands considerable time and effort and it should be linked and integrated with the existing planning and review process. It consists of many steps. The main steps are:

- 1-Collecting data from organization
- 2-Assessing the collected data by assessors
- 3-Linking the results to the business planning process

One of the objectives in this study was to develop a simple and effective self-assessment instrument using the developed TQM generic model for the Saudi construction industry organizations. However, the emphasis in this study on the method in which the self-assessment questionnaire should be derived, and how the self-assessment questionnaire should be validated, what appropriate scoring system should be used and how the effective progress evaluation guideline should be developed.

Therefore, the developed self-assessment instrument should consists of the following three parts to become useful:

- 1-Self-assessment questionnaire
- 2-Scoring system
- 3-progress evaluation guideline (achievement assessment graph)

The three parts: self-assessment questionnaire, scoring system and achievement assessment graph are forming an instrument capable of improving the performance of the construction industry business. It can help the organizations to look for opportunities for improvement. Also, it manages the continuous improvement process and links quality management with the strategic planning process within the organizations.

Also, it is going to help the Saudi construction industry organizations to identify and correct gaps in their performance and create continuous improvement process in the construction industry.

The developed self-assessment instrument can be named “ Quality Assessment Instrument for Saudi Construction Industry” or “QAISCI”. By developing QAISCI, the construction industry organizations in Saudi Arabia can identify and correct gaps in their performance. Also, they can benefit from a quick measure of their current quality performance using QAISCI and as a result they can have a continuous improvement process.

The emphasis in this part will be on the method in which the self-assessment questionnaire should be derived, how the questionnaire should be validated, what appropriate scoring mechanism should be used, and how the achievement assessment graph should be developed.

6.2.1 Development of self-assessment questionnaire

One of the components of self-assessment instrument is the “questionnaire” that generally creates reflection for the real status of the assessed organization. The assessment of performance through questionnaire is an important element in learning and continuous improvement. Therefore, questionnaire is the main part in the proposed self-assessment instrument and through it, the data can be collected from the assessed organizations.

As mentioned earlier, one of the objectives of this study was to develop a simple and effective self-assessment instrument using the developed TQM generic model for the

Saudi construction industry organizations. The emphasis in this part will be on the method in which the self-assessment questionnaire should be derived, and how the self-assessment questionnaire should be validated.

The developed self-assessment questionnaire has its basic elements from the assessment areas of the developed TQM generic model. The approach used to derive questionnaire was to model a questionnaire against the assessment areas of the developed TQM generic model (Table 6.1). There are 33 assessment areas for the sub-criteria in the developed TQM generic model and against those, 33 questions need to be derived.

The self-assessment questionnaire was derived in the way that it should examine whether organizations have the required approaches, to what extent the deployment of the approaches and the result from using the approaches. Therefore, the questionnaire was derived to assess the following three dimensions:

- 1- Presence of approach
- 2- Extent of deployment
- 3- Extent of positive trends in the result(for some assessment areas)

The criteria in the developed TQM generic model are non-prescriptive and as a result the developed self-assessment questionnaire will be generic for applicability in all the construction industry organizations in Saudi Arabia. Also, the use of verbal judgment to grade how well the organization conforms to the criteria by assigning a numerical value to each self-assessment questionnaire. The score of questionnaire is indicated by verbal judgment then converted to corresponding number that is registered in front of the self-assessment questionnaire as illustrated in Appendix A-part (iii).

Pre-testing was carried out, after developing an initial questionnaire, to ensure completeness and precision. Interviews were first conducted with three academicians in the field of TQM in order to improve the questionnaire progressively in terms of content validity (Nunnally, 1978).

The selection of the participants was designed to get maximum feedback from academicians in the field of TQM in both the UK and Saudi Arabia. They were asked

to comment on the clarity, appropriateness and accuracy of each statement in the questionnaire. The questionnaire was continuously modified and improved for the successive interviews. It was progressively improved in terms of content validity. The detailed study about the questionnaire validity is given below.

Validity and reliability of the self-assessment questionnaire

The questionnaire was subjected to a series of statistical tests to ascertain its validity and reliability as a measuring instrument.

The validity of a criterion refers to the extent to which a measure accurately represents what it is supposed to measure. Three different types of validity are generally considered: content validity, criterion-related validity, and construct validity.

1-Content validity is subjectively judged by the researchers and can not be evaluated numerically. It depends on how well the researchers created measurement items to cover the content domain of the variable being measured (Nunnally, 1967). The measurement items of the TQM generic model were selected based on an extensive review of the literature, therefore, the measurement items are considered to have content validity.

2-Criterion-related validity is concerned with the extent to which a measuring instrument is related to an independent measure of the relevant criterion (Nunnally, 1978). In other words, these measures taken together should account for the performance of the business unit with respect to the quality of its product or service.

3-Construct validity that refers to the degree to which a measure assesses the construct it is purported to assess. A measure is construct valid to the degree that it assesses the magnitude and direction of a representative sample of the characteristics of the construct and to the degree that the measure is not contaminated with elements from the domain of other constructs or errors.

Testing the criterion-related and construct validity required comparison between the results obtained from the self-assessment questionnaire and the actual scores obtained from the applications of large ten organizations in construction industry in Saudi Arabia. The ten organizations were from construction industry sector: four from client organizations, two from design consultant organizations and four from construction organizations and all they have TQM system.

The actual scores for the ten organizations were collected from quality assessors. The data was collected from two quality consultant centers offering TQM consultation services in the capital Riyadh and the average was taken for those two data. Also, the quality consultant centers are well known and famous in such service in Saudi Arabia. The following parts are the required procedures for testing the validity and reliability.

Survey methodology

There are a number of research methodologies for data collections available. The source of data through interview is the people. Interview questionnaire is the chosen method for collecting data since it provides more respondents, better and accurate information, and direct contact with the authority.

An interview questionnaire was developed for collecting data from organizations working in construction industry in Saudi Arabia. The interviewed persons may be the General Manager, TQM Manager, Quality Director, Quality Engineer, Quality Consultant, or other senior individuals dedicated to quality in the same organization. The results were scored in private by the researcher with persons involved in quality and in case the interview with more than one person in one organization, the results then were averaged for that organization.

The aim of this survey was to report in general terms about the findings from a number of large and medium organizations working in the construction industry and centralizing in three main cities: Riyadh, Jeddah, and Dammam. The main businesses of the medium and large organizations include; construction, consultancy services, oil, petrochemicals, and electricity generation.

It was important that the method of questioning was standardized to provide the opportunity for grouping the results together. The organizations, visited to interview member of staff, are working in the following sectors:

- Client organizations
- Consultant-design organizations
- Construction organizations

Preparation of questionnaire

The interview questionnaire was prepared realistic in its aims in the knowledge that the majority of organizations would approach TQM after QA. The interview questionnaire was designed for using when conducting interview with the clients, design consultants, and contractors. The interview questionnaire is illustrated in Appendix A.

The interview outline consists of the following sections:

- i) - General.
- ii) - Business questionnaire (section 6.3).
- iii) - Self-assessment questionnaire.
- iv) - Criteria comparison matrix (section 6.2.2).

A series of 33 self-assessment questionnaire were the basic areas representing the most important objectives for a TQM strategy. Also, a scale of 6 levels was used. A rating of “0” would indicate no development of the activity concerned while that of “5” would indicate that there was a very high emphasis of the activity. The score in this questionnaire is indicated by verbal judgment then converted to corresponding number that is registered in front of the self-assessment statement.

The responses were coded to enable them to be computer processed using SPSS (statistical package for the social sciences) for Window version 9.

The prospective samples were primarily identified from the list of ISO 9000 certified organizations published by The Saudi National Quality Committee (SNQC) in addition to the information collected from quality consultant centers (two offices). As mentioned in Chapter 3, more than 600 organizations in Saudi Arabia certified for

ISO 9000. The rationale behind the approach was that the certified organizations have a quality system in place and the executives are knowledgeable about the quality activities of their respective organizations.

Profile of the respondents

In total, 119 of the 168 concerned organizations having ISO 9000 agreed to participate based on an initial contact through telephone and of these 119 organizations 7 organizations could not complete the interview for some reasons.

Of these 112 organizations, 47 were from construction client organizations, 22 were from consultant-design organizations, and the remaining 43 were from construction organizations as presented in Figure 6.1.

The contractors covered in this survey are having high classification grade (first, second and third grades as illustrated in Chapter 4). The high response rate could be attributed to either the direct and personal/telephone approach by the researcher before the survey or the level of interest in the subject.

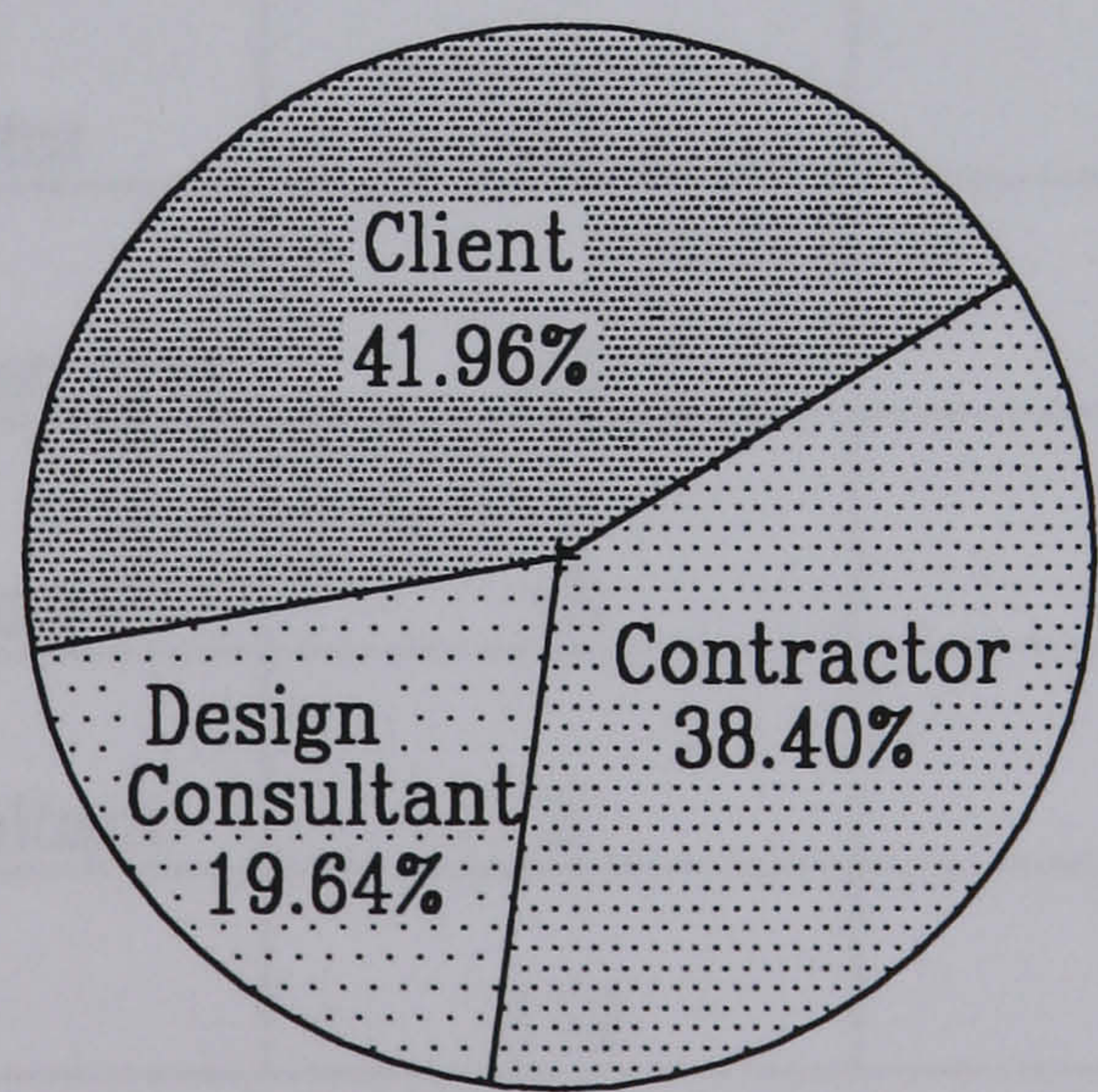


Fig.(6.1): PROFILE FOR THE RESPONDING ORGANIZATIONS

More than 70% of the sample came from the senior management group where almost 45% of the sample have a personal involvement in quality management for more than 3 years and the remaining 55% have personal involvement ranging from 1 to 3 years. A profile illustrating the current position of the persons in the sample is shown in Table 6.2.

Of the 112 organizations, 34% implemented ISO 9001/9002 since more than 5 years, 49% implemented ISO 9001/9002 since 3 to 5 years and the remaining 17% since 1 to 2 years as shown in Figure 6.2.

The head quarters of the sampled organizations where 48.2% (54 organizations) in the central region “ Riyadh”, 29.5% (33 organizations) in the western region “Jeddah”, and the rest 22.3 % (25 organizations) in the eastern region “Dammam”.

TABLE (6.2) : POSITIONS OF INTERVIEWED PERSONS

| current position | Frequency | Percentage |
|---------------------|-----------|------------|
| General Manager | 29 | 25.9 |
| Quality Director | 37 | 33 |
| TQM Program Manager | 24 | 21.4 |
| Quality Engineer | 19 | 17 |
| TQM Consultant | 3 | 2.7 |
| total | 112 | 100 |

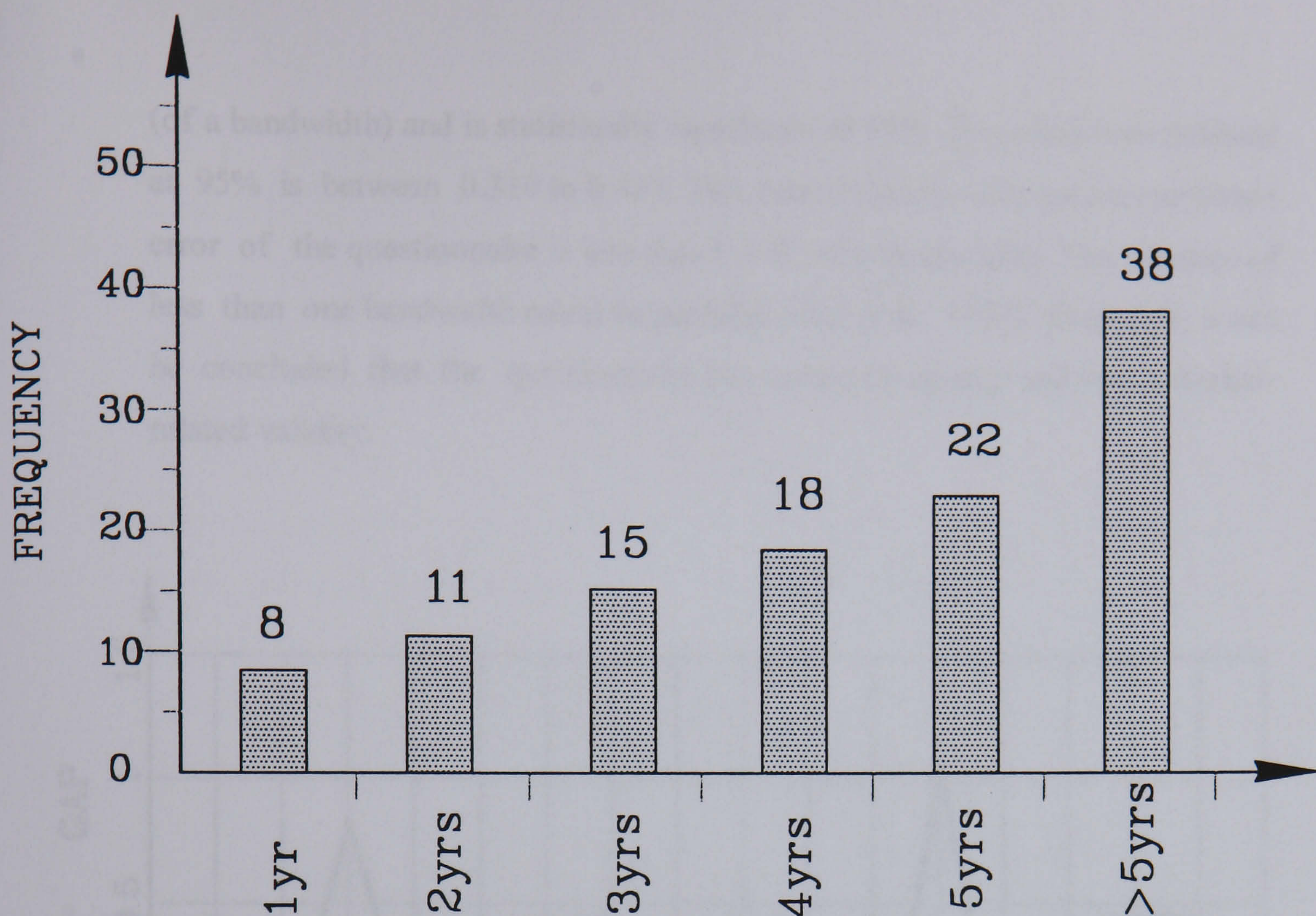


FIG.(6.2): ISO 9000 IMPLEMENTATION HISTORY

Testing criterion-related validity and construct validity

Testing criterion-related validity and construct validity required comparison between the results obtained from the self-assessment instrument “SAI” and actual scores obtained from the quality consultant centers from the applications for ten organizations “QCC”. The method of comparison is through three levels: at sub-criteria level, criteria level, and overall level of the TQM generic model.

1- *Sub-criteria level*. There are 33 sub-criteria in the seven criteria of the TQM generic model. Scores from the questionnaire and from the quality consultants were first converted to bandwidths (0-5). The analysis steps are as follow :

- a- The difference between SAI’s bandwidth score and QCC’s bandwidth score for each sub-criterion was computed. The largest positive bandwidth gap was 1.05. Figure 6.3 illustrates the bandwidth gap for all the 33 self-assessment questionnaires.
- b- A statistical test on the paired difference between SAI and QCC bandwidths for each sub-criterion was carried out. The results are given in Table 6.3. The mean paired difference (SAI score - QCC score) for all the 33-items is 0.372

(of a bandwidth) and is statistically significant at 95%. The confidence interval at 95% is between 0.310 to 0.433. This means that the average measurement error of the questionnaire is less than 0.372 (of a bandwidth). The variance of less than one bandwidth could be justified (Fox et al., 1993). Therefore, it can be concluded that the questionnaire has construct validity and thus criterion-related validity.

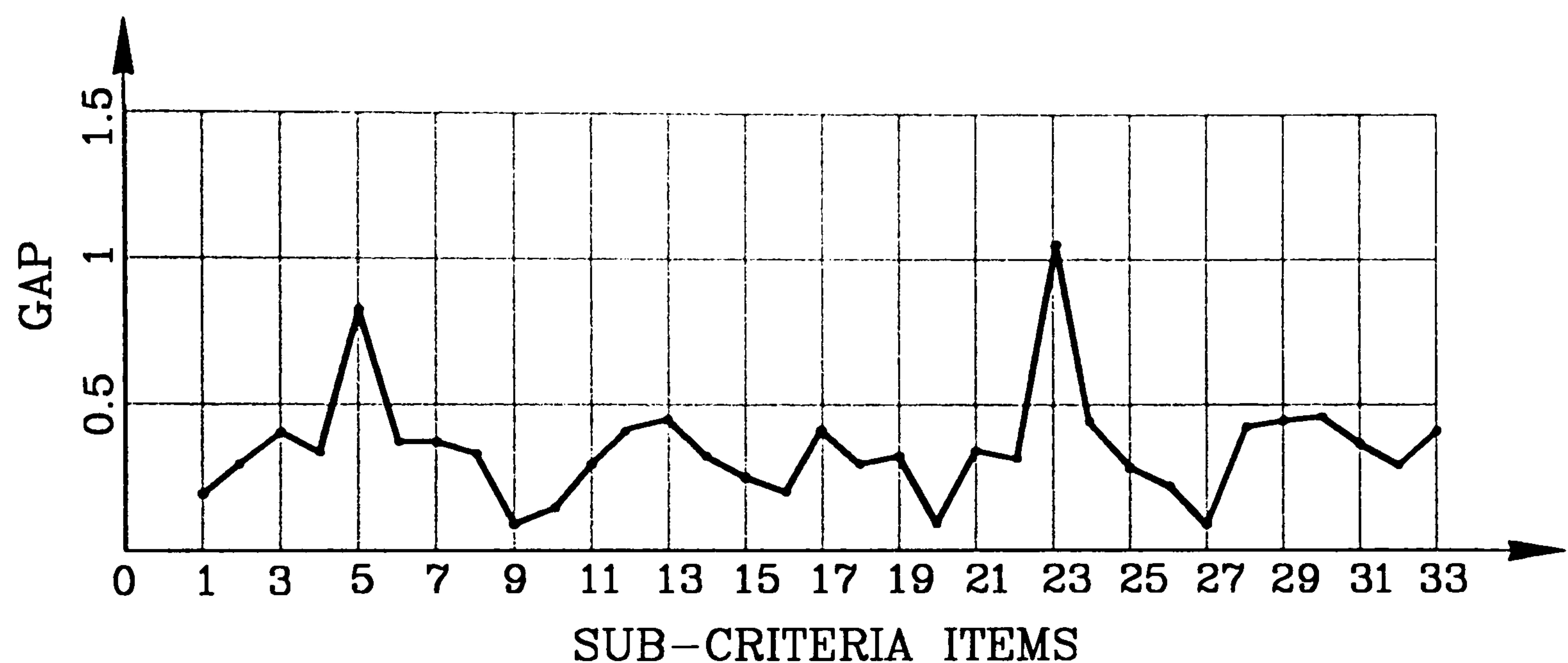


FIG.(6.3): MEAN BANDWIDTH GAP FOR THE 33 SUB-CRITERIA

TABLE (6.3) : SUB-CRITERIA LEVEL PAIRED SAMPLE TEST

| Paired Differences | | | | |
|--------------------------------|-------|-----------------------|----------------|-------|
| SUB-CRITERIA LEVEL TEST | Mean | standard Deviation | 95% Confidence | |
| | 0.372 | 0.179 | Lower | Upper |
| | | | 0.311 | 0.433 |

2- *Criteria level.* There are 7 criteria in the TQM generic model. Scores from the questionnaire and from the quality consultants were first converted to bandwidths (0-5) where the average score for sub-criteria scores was taken to form the score for each criterion. The analysis steps are as follow :

- a- The gap for each criterion were computed at criteria level, the largest positive bandwidth gap is 0.458 and the biggest negative bandwidth gap is -0.363 as shown in Figure 6.4 where the bandwidth gap for all seven criteria are computed.
- b- A statistical test on the paired difference between SAI and QCC bandwidths for each criterion was carried out. The results are illustrated in Table 6.4. The mean paired difference (SAI score - QCC score) for all the seven criteria is 0.350 (of a bandwidth) and is statistically significant at 95%. The confidence interval at 95% is between 0.301 to 0.399. This means that the mean difference between SAI scores and QCC scores at criteria level is statistically significant.

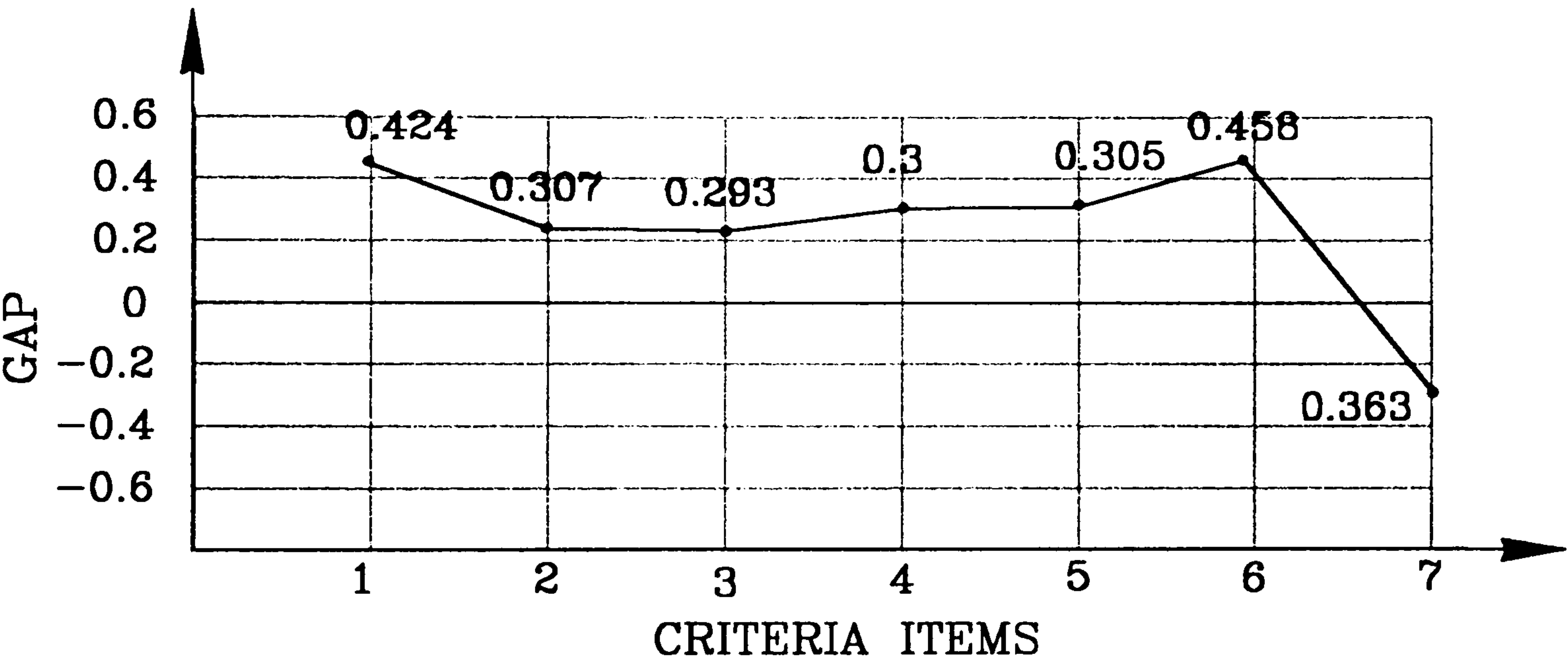


FIG. (6.4) : BANDWIDTH GAP FOR THE 7 CRITERIA.

TABLE (6.4) : CRITERIA LEVEL PAIRED SAMPLE TEST

| Paired Differences | | | | |
|------------------------|-------|-----------------------|----------------|-------|
| CRITERIA LEVEL TEST | Mean | standard Deviation | 95% Confidence | |
| | 0.350 | 0.067 | Lower | Upper |
| | | | 0.301 | 0.399 |

In summary, the relatively small difference may be considered acceptable (Fox et al., 1993). In the case of self-assessment, it can be concluded that the questionnaire has construct validity and criterion validity.

3- *Overall level.* In the overall level, the total scores for the questionnaire of SAI and QCC were compared. A paired test was conducted indicating that the mean difference is 0.210 but it is not significant at the 95 % level. The results are given in Table 6.5 where the confidence interval at 95% is between -0.003 to 0.423. Therefore, it can be concluded that at the overall level, the scores from SAI and QCC show that in terms of bandwidth there is no significant difference that confirms the questionnaire has both construct and criterion validity.

TABLE (6.5) : OVERALL LEVEL PAIRED SAMPLE TEST

| Paired Differences | | | | |
|--------------------|-------|--------------------|----------------|-------|
| OVERALL LEVEL TEST | Mean | standard Deviation | 95% Confidence | |
| | 0.210 | 0.154 | Lower | Upper |
| | | | – 0.003 | 0.423 |

Testing for reliability

Reliability testing was also conducted on the self-assessment questionnaire. The testing for reliability will verify whether the questionnaire is providing accurate measurement. By focusing on the macro level, the approach used was to evaluate the correlation coefficient of the sub-criteria scores and the seven criteria scores obtained from the questionnaire against those from QCC. A high correlation coefficient would imply that the questionnaire’s measurement is accurate and the questionnaire is reliable. A correlation coefficient greater than 0.60 means strong correlation (Fox et al., 1993) and an acceptable indication of good reliability.

1- Sub-criteria level. The correlation coefficient between SAI and QCC sub-criteria scores is 0.651. It means that the sub-criteria scores of SAI correlate positively with that of QCC scores.

2- Criteria level. The correlation coefficient between SAI and QCC criteria scores is 0.795 that means the criteria scores of SAI correlate positively with that of QCC scores.

Therefore, both the validity and reliability of the questionnaire is verified and as a result the self-assessment questionnaire forming the self-assessment instrument is valid and reliable.

6.2.2 Scoring methodology for the self-assessment questionnaire

The questionnaire in the self-assessment is the main part in any quality assessment instrument and without scoring system, the questionnaire cannot provide any measure for quality. The objective scoring system has to be derived from responses entered in the questionnaire. The objective scoring system should have the ability to differentiate the overall performance of quality management practices in an organization and the respective performance in each of the seven criteria of the developed TQM generic model.

The scores in MBNQA are continuously updated where the scores in version 1999 are different than version 2000. As a result, the scoring system for the TQM generic model needs to be studied based on the culture of organizations in Saudi Arabia. The total score “1000 points” that of MBNQA would be taken into account when computing scores for self-assessment. The total score or the “1000 points” needs a survey to know the right distribution of these points on the seven criteria of the TQM generic model for the construction industry organizations in Saudi Arabia. Therefore, each criterion is going to have a score or weight and the weight for each criterion should be divided into percentiles, such as 20th, ...30th likewise and distributed over the assessment areas. Also, the score for each assessment area is divided into six equal ranges.

Pair-wise comparison matrix was developed comparing the importance of criteria to quality culture whereby the items to be compared will follow the exact nature and structure of the criteria used in the generic model.

Also, in this study an achievement assessment graph is to be developed based on the material found in the literature so that the developed self-assessment instrument can be said complete and effective for the construction industry organizations in Saudi Arabia. The achievement assessment graph is very helpful in determining the level of TQM for an organization by which the improvement and progress in performance can be tracked.

Weight determination mechanism

The assessment process, for assigning score for each criterion in the generic model, consists of three steps:

The first step is to assess the current organization culture through a scoring scheme that reflects the status of the organization culture using the criteria of the generic model that constitutes a quality culture. The second step is to assess the importance of each criterion in comparison with other criteria. In the third step, a weight expressing the importance for each criterion is to be determined. Appendix A- (part iv) shows the format that is going to be used in the interview.

Survey methodology

Comparison format was developed for collecting data from organizations working in construction industry in Saudi Arabia through interview. The interviewed persons may be the General Manager, Quality Director, TQM Manager, Quality Engineer, Quality Consultant, or it can be other senior individuals dedicated to quality in the same organization.

It was important that the method of questioning was standardized to provide the opportunity for grouping the results together. The organizations, visited to interview member of staff, are working in the following sectors:

- Client organizations
- Consultant-design organizations
- Construction organizations

In this study, AHP (analytical hierarchy process) is going to be used for weight determination. AHP is one of the known methods in the literature for weight determination. It requires a matrix of pair-wise comparison of the criteria. The entries of the matrix indicate the strength with which one criterion dominates the other in its importance for quality culture. The a_{ij} element of the matrix is defined as the intensity of importance criteria i in comparison to criteria j or $a_{ij}=1/a_{ji}$.

The relative importance of each criterion used in the AHP was collected through the survey. The format of the questionnaire was synthesized with reference to Saaty (1994).

A scale of 9 levels was used in the AHP analysis. A rating of “1” would indicate equal importance, “3” for weak importance of one criteria over another, “5” for strong importance, “7” for demonstrated importance, “9” for absolute importance. The values 2,4,6,and 8 are intermediate values.

The pair-wise comparison for the seven criteria was done comparing the importance of criteria to quality culture. Criteria are compared pair-wise with respect to each criterion at the adjacent upper level and working down. The element that appears in the left-hand column is always compared with the element appearing in the top row, and the value is given to the element in the column as it is compared with the element in the row.

The arithmetic mean for all comparison matrices is computed for values resulting from all the responding organizations. Also, the fractions are omitted. The pair-wise comparison matrix for all the responding organizations is given below in Table 6.6. The scale of importance is given on the right for easiness and simplicity in comparison.

TABLE (6.6) : MEAN PAIR-WISE COMPARISON MATRIX FOR THE RESPONDING ORGANIZATIONS

| TQM CRITERIA | LEADERSHIP | STRATEGIC PLANNING | CUSTOMER AND MARKET FOCUS | INFORMATION AND ANALYSIS | HUMAN RESOURCE FOCUS | PROCESS MANAGEMENT | BUSINESS RESULTS | Scale |
|---------------------------|------------|--------------------|---------------------------|--------------------------|----------------------|--------------------|------------------|-------------------|
| | | | | | | | | Equal 1 |
| LEADERSHIP | 1 | 2 | 1 | 3 | 2 | 3 | 1/4 | Intermediate 2 |
| STRATEGIC PLANNING | 1/2 | 1 | 1/2 | 2 | 2 | 2 | 1/6 | Weak 3 |
| CUSTOMER AND MARKET FOCUS | 1 | 2 | 1 | 2 | 2 | 3 | 1/5 | Intermediate 4 |
| INFORMATION AND ANALYSIS | 1/3 | 1/2 | 1/2 | 1 | 1 | 1 | 1/6 | Strong 5 |
| HUMAN RESOURCE FOCUS | 1/2 | 1/2 | 1/2 | 1 | 1 | 1 | 1/6 | Intermediate 6 |
| PROCESS MANAGEMENT | 1/3 | 1/2 | 1/3 | 1 | 1 | 1 | 1/6 | Demonstrated 7 |
| BUSINESS RESULTS | 4 | 6 | 5 | 6 | 6 | 4 | 1 | Intermediate 8 |
| | | | | | | | | Absolute 9 |

The relative weights of the elements of each level with regard to an element on the next level are computed as the components of the normalized eigenvector associated with the largest eigenvalue of their comparison matrix. The normalized matrix is given in Table 6.7. The composite weights of the decision alternatives are then determined by aggregating the weights throughout the hierarchy. Weight resulting from applying the standard methodology of AHP is given in Table 6.8. The weight of each criterion is rounded to nearest value of 5 or 10 for easiness in distribution over the elements of TQM model.

The results showed different scores for the TQM generic model in comparison with that of MBNQA but the difference is not that much except for the two criteria: “leadership” and “customer and market focus”. The obtained scores reflect the actual scoring system needed for assessing the achievement of TQM in the Saudi organizations.

TABLE (6.7) : NORMALIZED MATRIX

| TMQ CRITERIA | LEADERSHIP | STRATEGIC PLANNING | CUSTOMER AND MARKET FOCUS | INFORMATION AND ANALYSIS | HUMAN RESOURCE FOCUS | PROCESS MANAGEMENT | BUSINESS RESULTS | WEIGHT |
|---------------------------|-------------------|--------------------|---------------------------|--------------------------|----------------------|--------------------|------------------|--------------------|
| LEADERSHIP | 6/46 ^a | 4/25 | 6/53 | 3/16 | 2/15 | 3/15 | 15/127 | 0.142 ^b |
| STRATEGIC PLANNING | 3/46 | 2/25 | 3/53 | 2/16 | 2/15 | 2/15 | 10/127 | 0.092 |
| CUSTOMER AND MARKET FOCUS | 6/46 | 4/25 | 6/53 | 2/16 | 2/15 | 3/15 | 12/127 | 0.121 |
| INFORMATION AND ANALYSIS | 2/46 | 1/25 | 3/53 | 1/16 | 1/15 | 1/15 | 10/127 | 0.078 |
| HUMAN RESOURCE FOCUS | 3/46 | 1/25 | 3/53 | 1/16 | 1/15 | 1/15 | 10/127 | 0.084 |
| PROCESS MANAGEMENT | 2/46 | 1/25 | 2/53 | 1/16 | 1/15 | 1/15 | 10/127 | 0.087 |
| BUSINESS RESULTS | 24/46 | 12/25 | 30/53 | 6/16 | 6/15 | 4/15 | 60/127 | 0.394 |

a This value is obtained by dividing the leadership entry results in the comparison matrix by the leadership column total

b This value is obtained as follows: $(6/46+4/25+6/53+3/16+2/15+3/15+15/127) / 7 = 0.142$

TABLE (6.8) : WEIGHT OF CRITERIA AFTER APPLYING AHP

| Serial | TQM Criteria | Weight(rounded) | Score |
|--------|---------------------------|-----------------|-------|
| 1 | LEADERSHIP | 0.140 | 140 |
| 2 | STRATEGIC PLANNING | 0.09 | 90 |
| 3 | CUSTOMER AND MARKET FOCUS | 0.120 | 120 |
| 4 | INFORMATION AND ANALYSIS | 0.08 | 80 |
| 5 | HUMAN RESOURCE FOCUS | 0.085 | 85 |
| 6 | PROCESS MANAGEMENT | 0.090 | 90 |
| 7 | BUSINESS RESULTS | 0.395 | 395 |
| | TOTAL | 1 | 1000 |

The weight of each criterion will be distributed in almost equal amount on the assessment areas of sub-criteria. A gain, the amount of weight of each assessment area is distributed over a scale of 0 to 5 as per the self-assessment questionnaire in Appendix A-part (iii). The score for each level equals 20% of the sub-amount starting from zero for “none” and ending with the highest for “very high emphasis” as illustrated in appendix B. The summation of scores for the highest level “very high emphasis” in the self-assessment instrument is 1000 points that is the maximum an organization can achieve.

6.2.3 Development of achievement assessment graph

An achievement assessment graph was developed based on the material found in the literature: quality maturity grid presented by Crosby (1979), the MBNQA scores scale, and the ECI achievement assessment graph. With the developed graph, the level of organization in terms of quality maturity can be easily made visible. The organization’s level of progress can be presented in relation to the TQM vision and goals. Also, the communication throughout employees within organization will be better using the developed graph when they become aware of the steps that should be taken to improve the organization level to the next level of quality maturity.

The maximum score used was based on MBNQA 1000 points scale instead of 60 points that of ECI scores. Also, the quality levels developed by Crosby and the percentage progress of ECI was considered during the development of the assessment graph. The characteristics that describe the mentality in the organization are:

- **Uncertainty** : management commitment is required at this stage to overcome resistance to change.
- **Awakening** : first signs of improvement are seen.
- **Enlightenment**: continuous quality improvements have been made and some benefits are visible.
- **Empowerment**: a world class construction operations with some improvements still left to make and employees feel enabled to make improvements.
- **Wisdom** : total quality in the organization is recognized and employees Knows why they do not have problems with quality.

Figure 6.5 illustrates the developed achievement assessment graph for the TQM generic model for the Saudi construction industry organizations by which a level of progress can be identified for an organization.

The developed three parts: self-assessment questionnaire, scoring system and achievement assessment graph is forming an instrument named “QAISCI” and it is capable of measuring the TQM level in organizations within the construction industry sector in Saudi Arabia. It can help the organizations to look for opportunities for improvement. Also, it manages the continuous improvement process and links quality management with the strategic planning process within the organizations. The developed self-assessment instrument or “QAISCI” is illustrated in Appendix B.

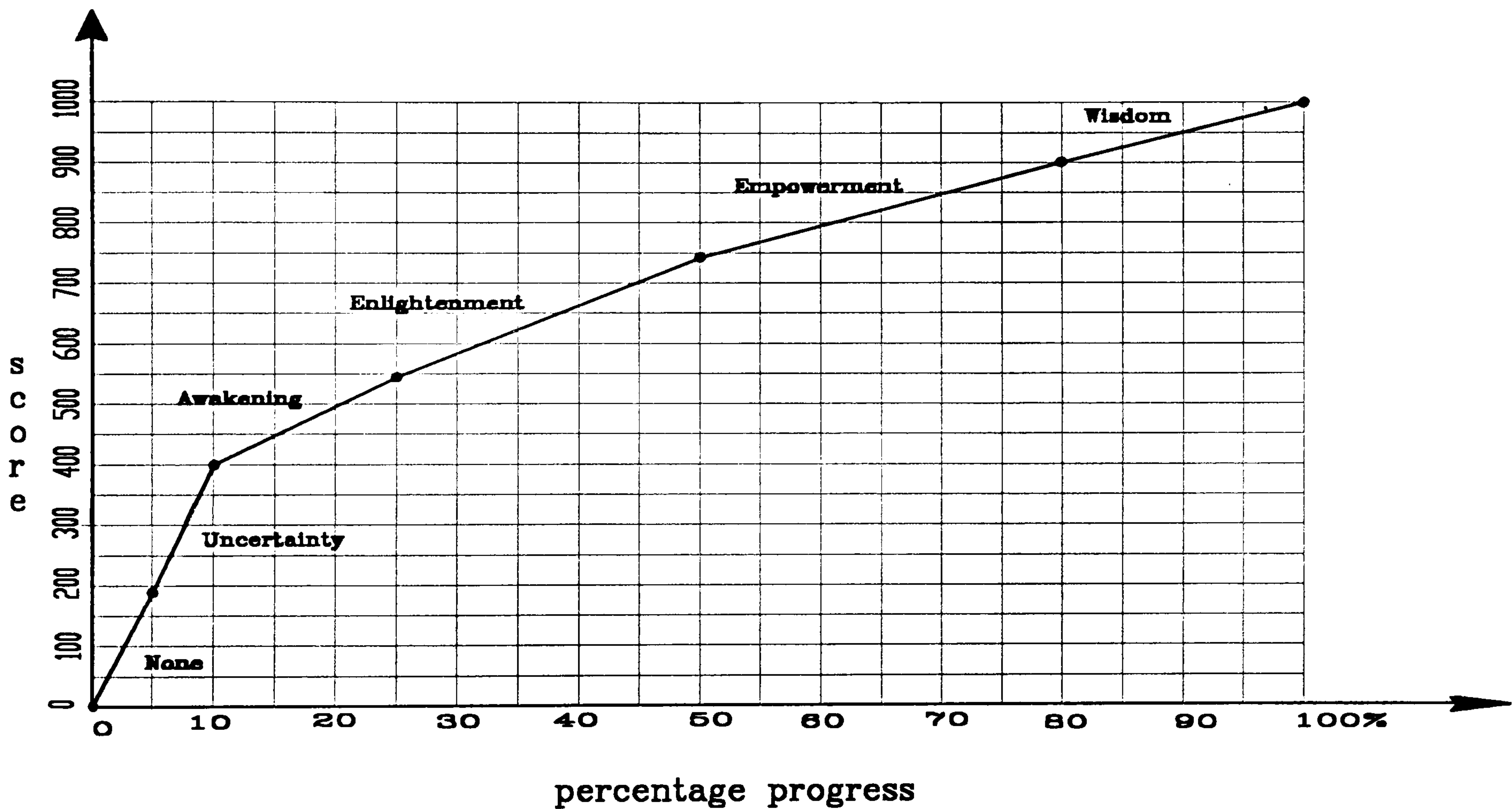


FIG.(6.5) : ACHIEVEMENT ASSESSMENT GRAPH

6.3 TQM in practice within the Saudi construction industry organizations

Many organizations in Saudi Arabia have taken a step ahead to implement TQM and they have succeeded at this stage. The awareness is growing in Saudi Arabia about the cultural aspects of introducing TQM in organization life. The relation of TQM to the evolving local culture with the multinational workforce needs more attention to overcome obstacles and meet common goals.

Three main cities in Saudi Arabia have most of the construction activities in addition to large organizations and hence the study in this research will cover the specified three cities; Riyadh the capital, Jeddah the port on the Red Sea, and Dammam the other port on the gulf. In these three cities the local culture and weather are almost the same except more humidity in Jeddah and Dammam.

Survey methodology

The survey questionnaire (QAISCI) was used for collecting data from organizations working in construction industry in Saudi Arabia. The interview was held as mentioned in section 6.2.1 with different persons such as the General Manager, Quality Director, TQM Manager, Quality Engineer, or Quality Consultant.

The aim of this survey was to report in general terms about the findings from a number of large and medium organizations working in the construction industry and centralizing in three main cities: Riyadh, Jeddah, and Dammam.

It was important that the method of questioning was standardized to provide the opportunity for grouping the results together. The interviewed organizations are working in the following areas:

- Client organizations
- Consultant-design organizations
- Construction organizations

The responses were coded to enable them to be computer processed using SPSS (statistical package for the social sciences) for Window version 9.

Preparation of questionnaire

QAISCI is going to be used for assessing the progress of TQM within the Saudi construction industry organizations. Also, there is no need to conduct a new survey questionnaire since the results of the self-assessment questionnaire in section 6.2.1 will be replaced with the new scores (weights) as per the distribution of scores presented in Appendix B.

A series of 33 self-assessment statements were the basic areas representing the most important objectives for a TQM strategy. Each objective has a scale of six levels of attainment starting from no emphasis of the activity for the specified sub-criterion and ends with a very high emphasis of the activity. The score in this questionnaire survey is indicated by verbal judgment then converted to corresponding number that is registered in front of the self-assessment statement and finally, the total score for each organization can be computed.

In addition, part II of the questionnaire “ the business questionnaire ” was designed to collect information for analysis purposes about the ownership of the organization, number of employees and annual sales. Also, the survey was designed to study current practices in TQM and the problems facing TQM such as benefits, barriers and pitfalls in TQM implementation. Many computer programs were used in this research for analysis and drawings such as AUTO CAD 2000 and EXCEL in addition to the main program mentioned before “SPSS”.

Profile of respondents

In terms of ownership Figure 6.6 illustrates the type of ownership for the responding organizations where the sole proprietorship was 37.50% of the surveyed organizations and next to it the partnership companies 24.10%. The associate companies and joint venture were 17.87% and 10.71% respectively in addition 9.82% for other types of ownership and big part of it government owned.

The distribution of employees in the responding organizations was also studied in this research. Of the total sample, 20.46% between 1 and 99 employees, 37.50% between 100 and 499, 23.2% between 500 and 999, and the remaining 18.84% of the total sample has more than 999 employees, as shown in Figure 6.7.

In addition, about 24.1% of these organizations had SR101 million and more as annual sales, 43.7% had SR51-100 million in sales, 17% had SR11-50 million, and the rest 15.2% had SR1-10 million in sales.

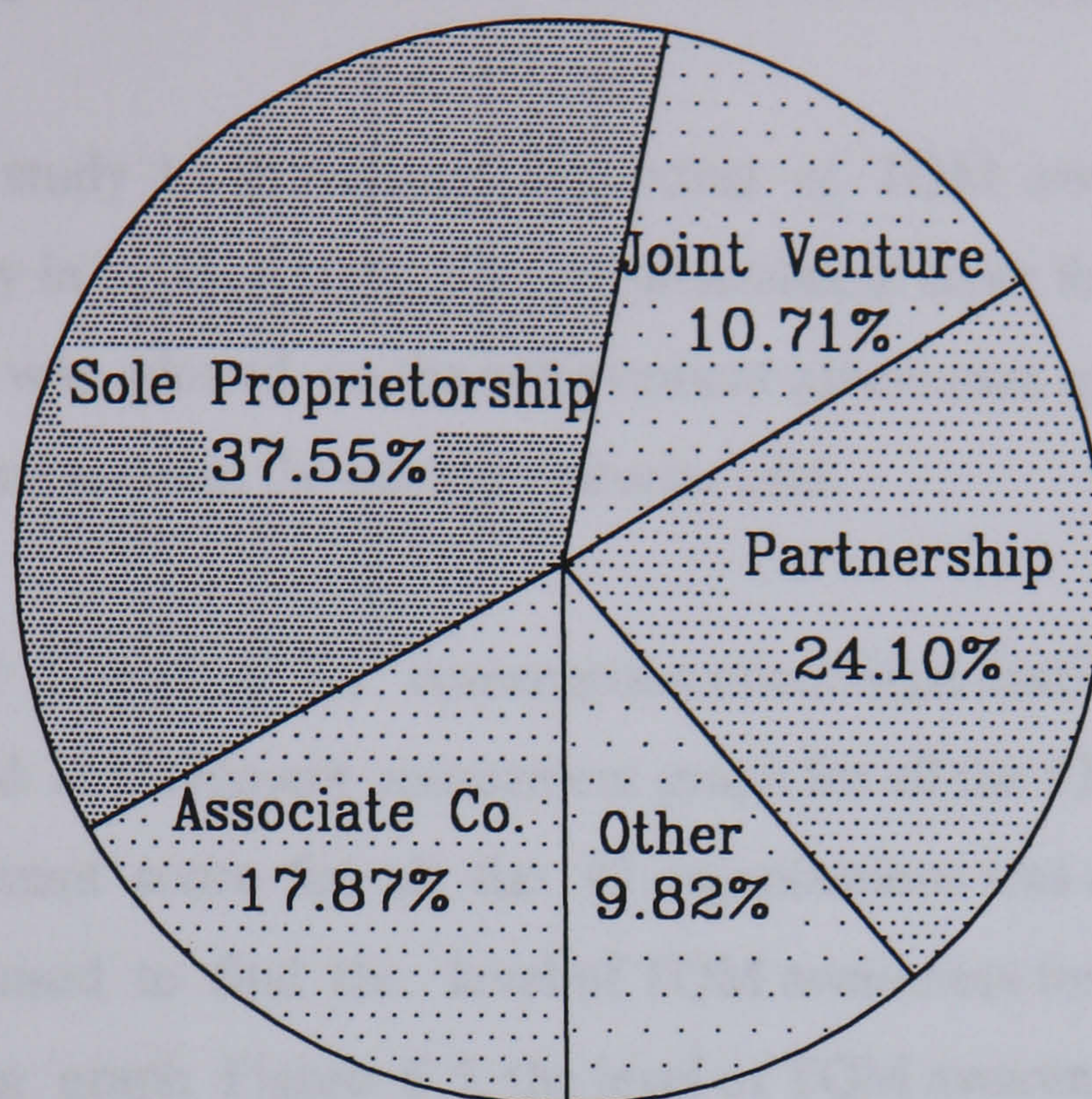


Fig. (6.6) :OWNERSHIP PROFILE FOR THE RESPONDING ORGANIZATIONS

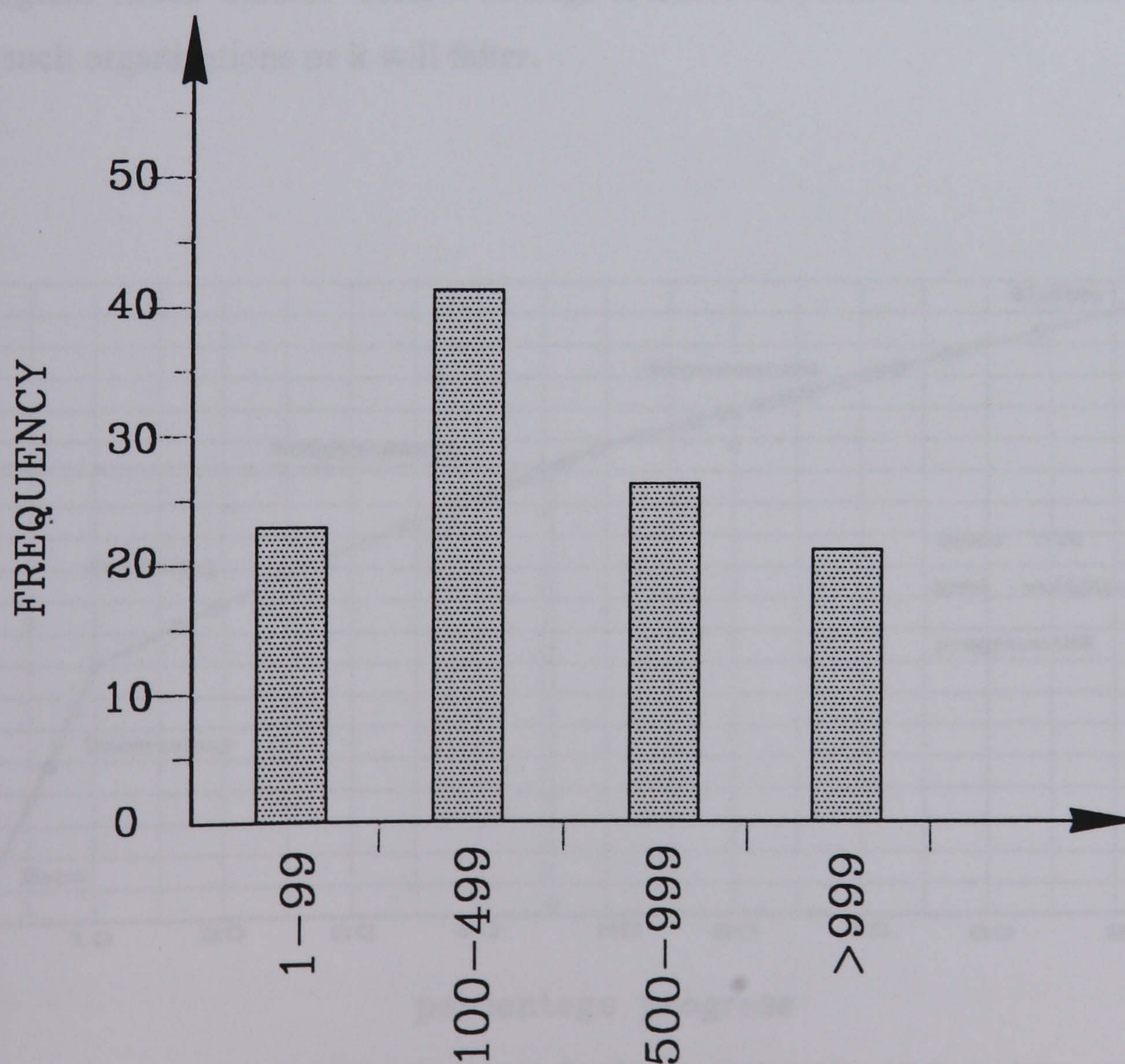


FIG. (6.7) : EMPLOYEES SIZE WITHIN THE ORGANIZATIONS

6.3.1 Analysis of TQM awareness within construction client organizations

This was the first study to investigate the extent of TQM awareness within the construction industry in Saudi Arabia. The self-assessment score for each construction client organization was plotted on the achievement assessment graph illustrating the position of that organization in the quality maturity grid.

The level of TQM awareness for construction client organizations was determined using the developed achievement assessment graph for all the 43 organizations. The average self-assessment score for all the 47 organizations was computed to be 710 points and it was used to find the level of TQM awareness for construction client organizations. Using graph Figure 6.5, the level of TQM awareness for construction client organizations appears to be "Enlightenment" with a percentage of progress towards full TQM equals to 46% as shown in Figure 6.8. The construction client organizations are realizing that continuous quality improvements have been made and some benefits in the business are visible. The researcher argues that the TQM program needs careful control through at least two years to see full benefits of TQM in such organizations or it will falter.

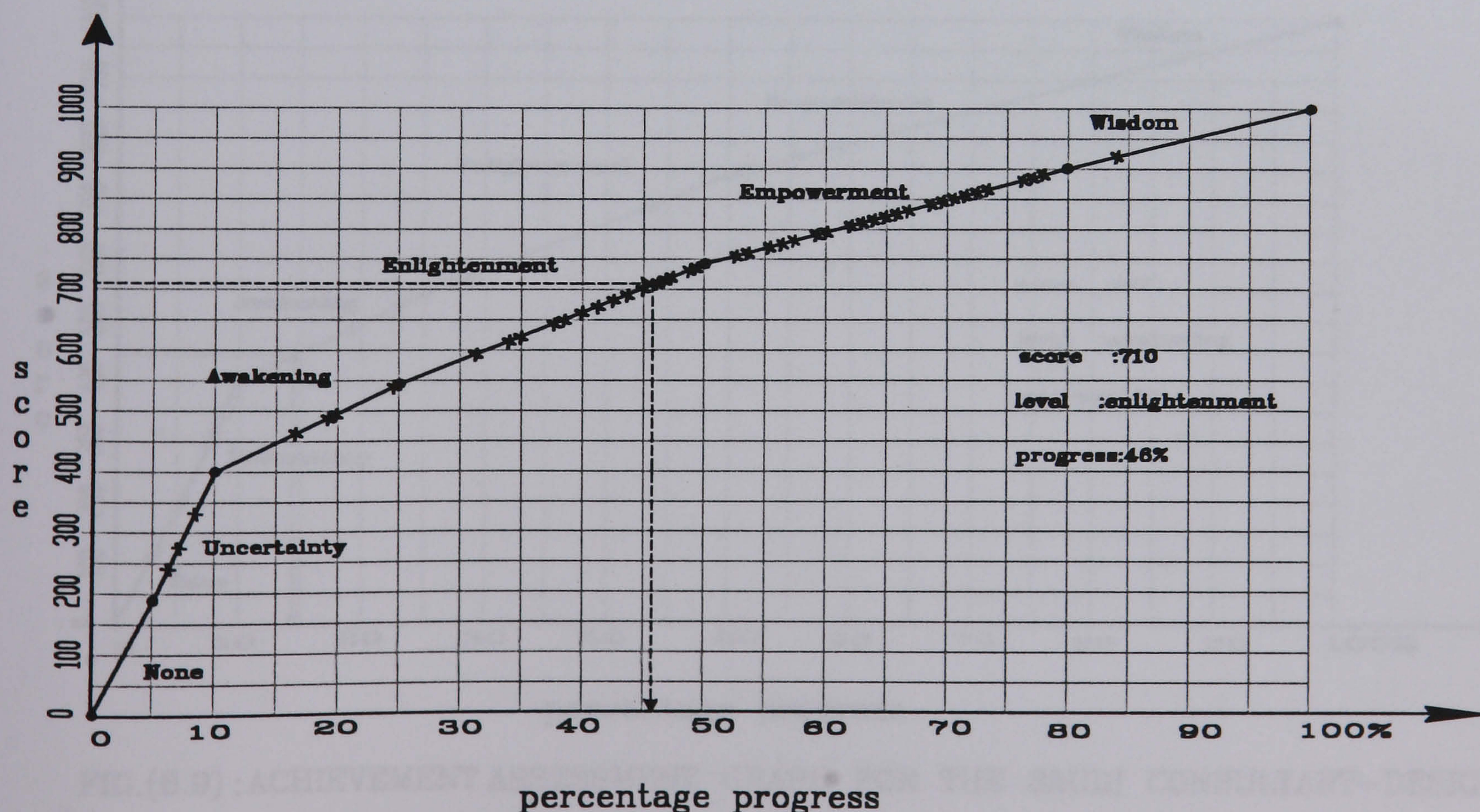


FIG.(6.8) ;ACHIEVEMENT ASSESSMENT GRAPH FOR THE SAUDI CONSTRUCTION CLIENT ORGANIZATIONS

6.3.2 Analysis of TQM awareness within consultant-design organizations

The self-assessment score for each consultant-design organization was plotted on the achievement assessment graph illustrating the position of that organization in the quality maturity grid.

The analysis was made for consultant-design organizations for 22 consultants. The level TQM of awareness for the consultant-design organizations was determined through the developed achievement assessment graph for all the 22 organizations. The average self-assessment score for the 22 organizations was calculated to be 440 points. Using graph Figure 6.5, the level of TQM awareness for consultant-design organizations appears to be “Awakening” with a percentage of progress towards TQM equals to 14.5% as presented in Figure 6.9. It seems that consultant-design organizations are seeing the first signs of improvement in the activities of the organization. The researcher suggests that an active promotion of continuous improvement is having an effect.

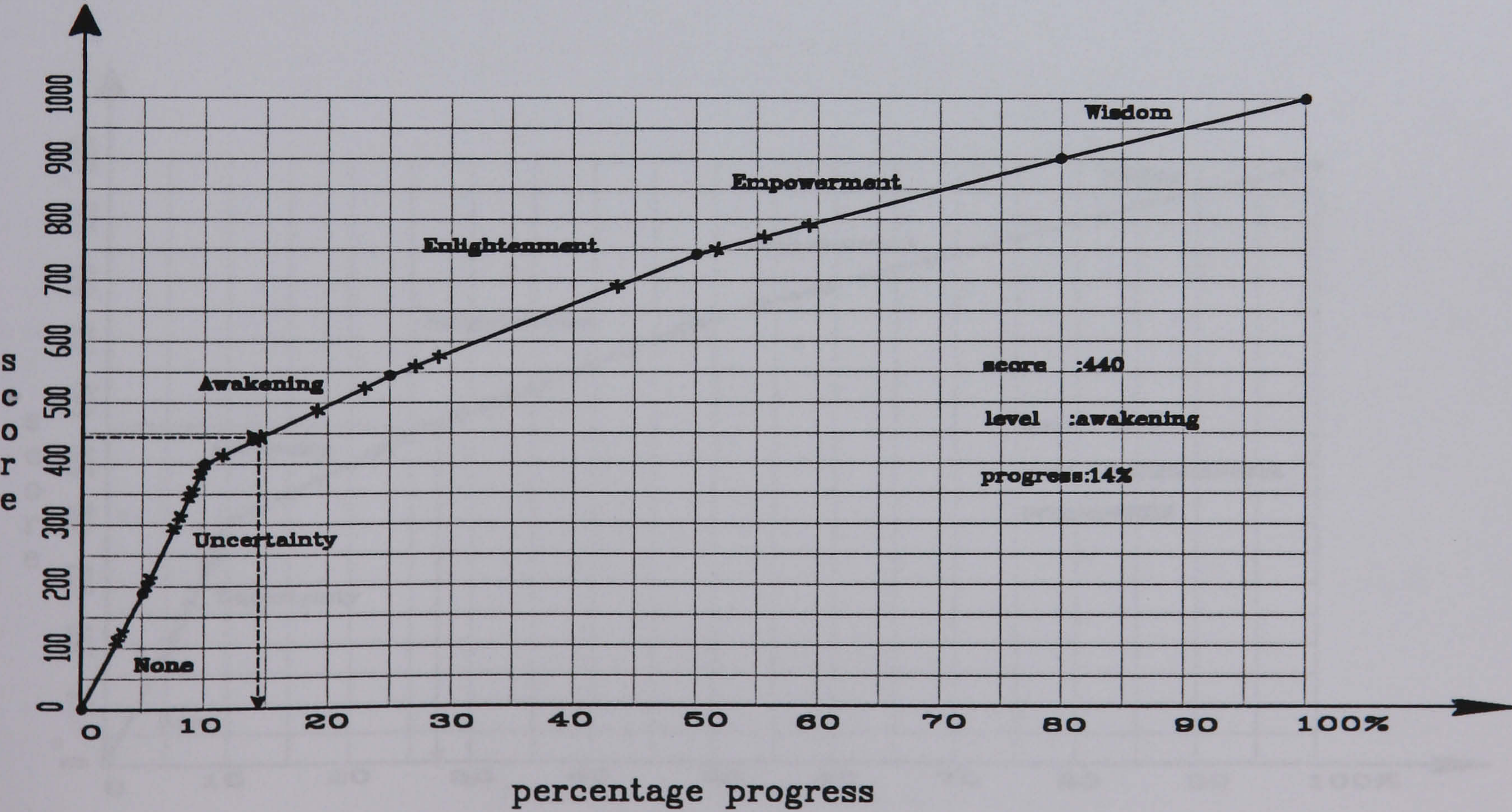


FIG.(6.9) : ACHIEVEMENT ASSESSMENT GRAPH FOR THE SAUDI CONSULTANT–DESIGN ORGANIZATIONS

6.3.3 Analysis of TQM awareness within construction organizations

The self-assessment score for each construction organization was plotted on the achievement assessment graph showing the position of that organization in the quality maturity grid.

The analysis was performed to investigate the extent of TQM awareness within construction organizations in Saudi Arabia. The level of TQM awareness for construction organizations was determined through the developed achievement assessment graph for all the 43 construction organizations. The average self-assessment score for the 43 organizations was counted to be 560 points and it was used to find the level of TQM awareness for construction organizations. Using graph Figure 6.5, the level of TQM awareness for construction organizations appears to be "Enlightenment" with a percentage of progress towards TQM equals to 27% as illustrated in Figure 6.10. The construction organizations are realizing that continuous quality improvements have been made and some benefits in the business are visible. The researcher argues that TQM program needs careful control at least two years to see the full benefits of TQM in construction organizations or it will falter.

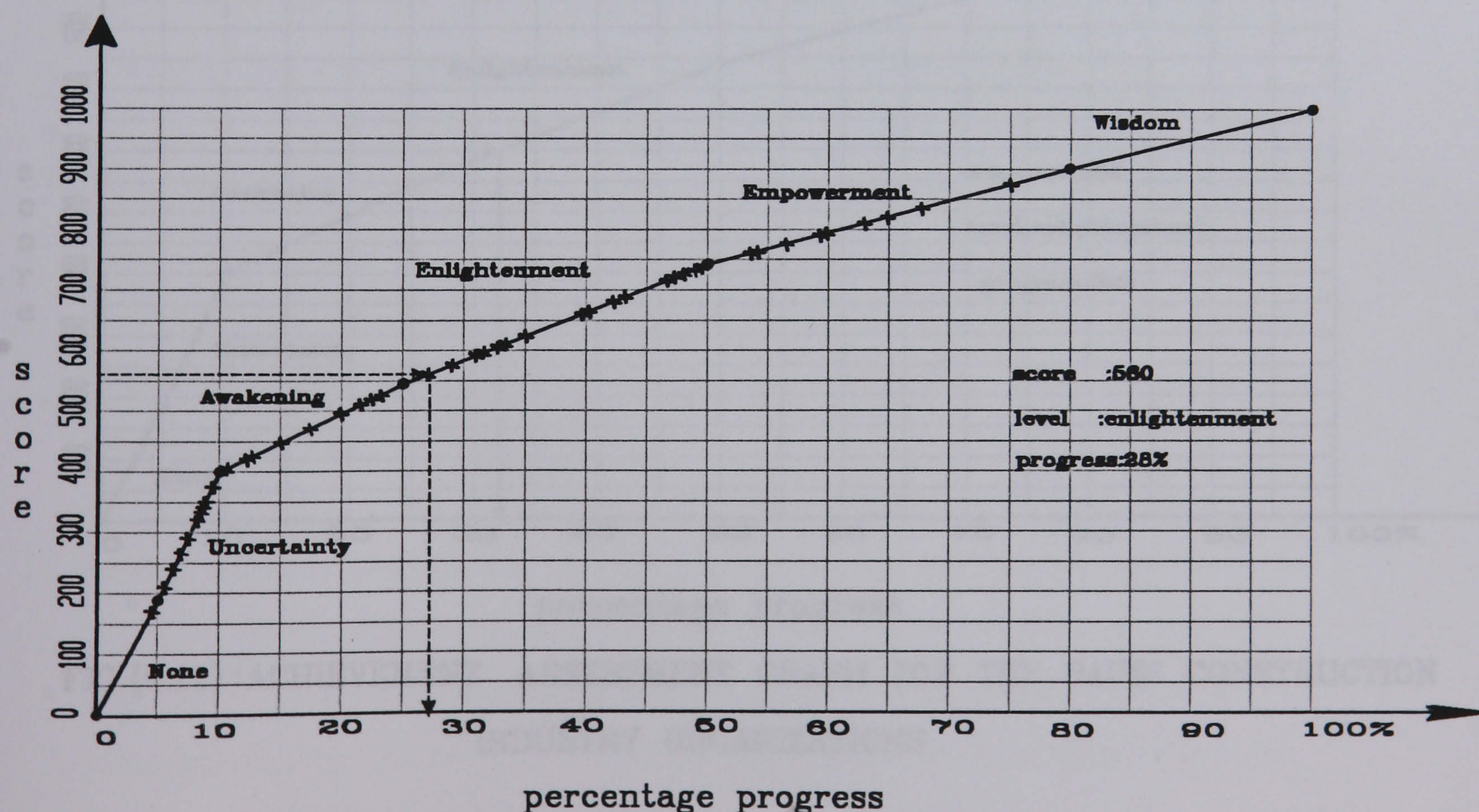


FIG.(6.10) :ACHIEVEMENT ASSESSMENT GRAPH FOR THE SAUDI CONSTRUCTION ORGANIZATIONS

6.3.4 General extent of TQM awareness in the Saudi construction industry sector

The same analysis was extended to investigate the extent of TQM awareness within construction industry organizations in Saudi Arabia. The level of TQM awareness for construction industry organizations was determined through the achievement assessment graph for all the 112 responding organizations together. The average self-assessment score for all the responding organizations was 600 points. The average score was used to find the level of TQM awareness for construction industry organizations. Using graph Figure 6.5, the level of TQM awareness for construction industry organizations in Saudi Arabia appears to be in the early stages of “Enlightenment” with a percentage of progress towards full TQM equals to 32%. Figure 6.11 illustrates the achievement assessment graph for construction industry organizations in Saudi Arabia.

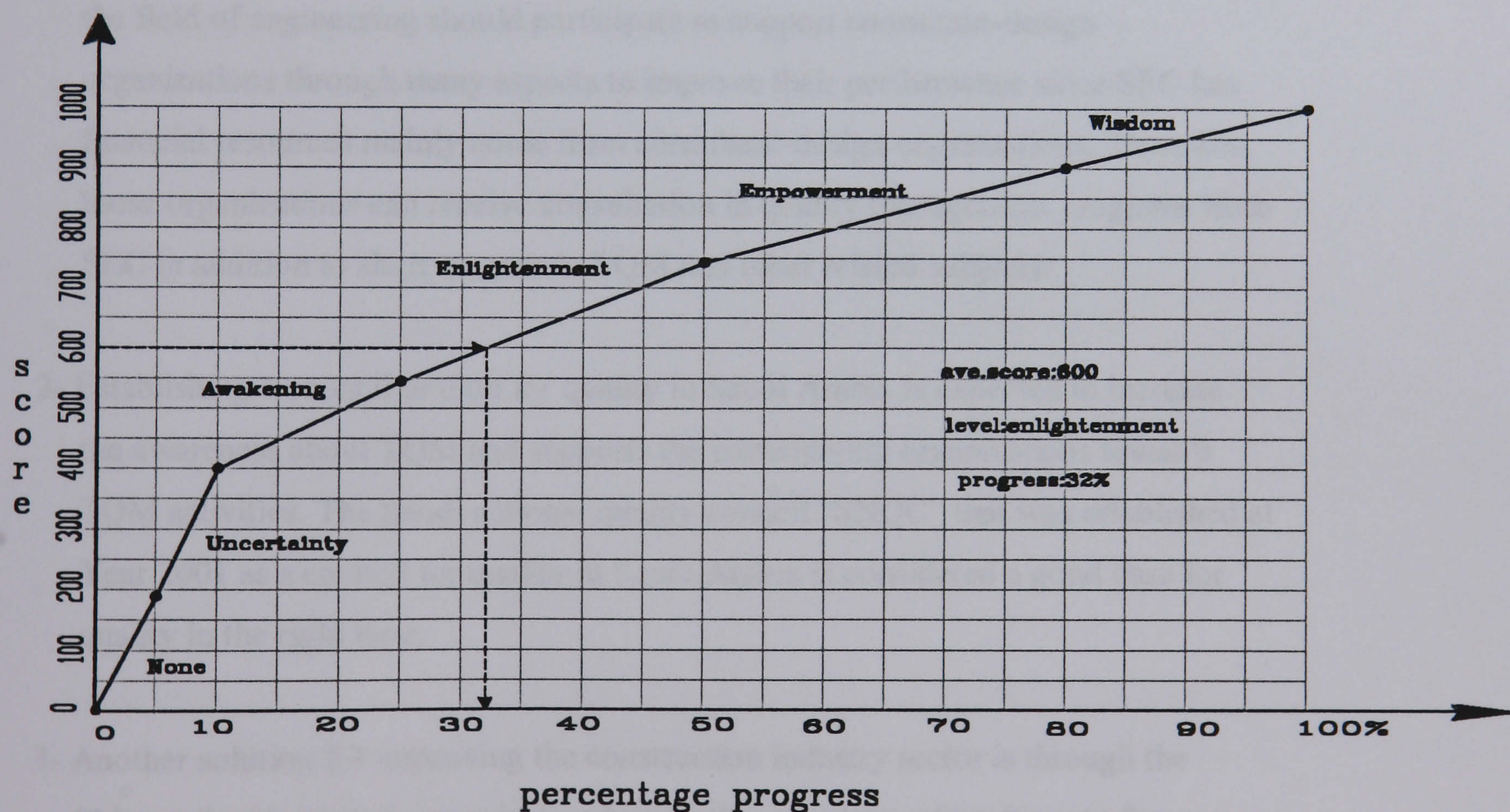


FIG.(6.11) :ACHIEVEMENT ASSESSMENT GRAPH FOR THE SAUDI CONSTRUCTION INDUSTRY ORGANIZATIONS

The percentages of progress indicate that the construction client organizations become the best sector among the construction industry organizations. This due to the advancement of those organizations since they are well known for their size and capabilities among those surveyed in this study.

The researcher argues that more attention for the consultant-design organizations should be made to increase the progress towards TQM since all other sectors in the construction industry are moving ahead. Also, the category of construction organizations that have shown low progress towards TQM should keep the improvement process continuous and carryout self-assessment process continuously.

The recommended solutions for improving the performance of consultant-design organizations and construction organizations are through the following suggestions:

- 1- The Saudi Engineering committee “ SEC ” and other supporting organizations in the field of engineering should participate to support consultant-design organizations through many aspects to improve their performance since SEC has financial resources mainly come from consultant-design organizations. Therefore, those organizations can receive consultation in quality management programs from SEC in addition to short courses in TQM and other related subjects.
- 2- Establishing a council or club for quality in Saudi Arabia is expected to increase the awareness about TQM and supports the participating organizations towards TQM activities. The Saudi national quality council “SNQC” that was established at Year 2001 as a council for quality in Saudi Arabia is considered a good base for quality in the right time.
- 3- Another solution for improving the construction industry sector is through the “Merger” with another organization having the same type of business to form an organization capable of competition in the market. Nowadays, merger between some organizations becomes a solution for improvement to better performance and for more market share.

4- Benchmarking is recommended as a process of learning from best in class. Organizations could use benchmarking as a tool to lead to general improvement throughout the construction industry. Managing self-assessment survey through a TQM consultant will assist in setting up benchmarking information within and outside the construction industry. Benchmarking can be done through two formal approaches: a process benchmarking or performance benchmarking as mentioned earlier in chapter 2. Therefore, the construction industry organizations surveyed in this study could use process benchmarking to learn from the best organizations in class. Benchmarking for consultant-design organizations and construction organizations will be only discussed as an example in the following section since those two sectors have shown low progress towards TQM more than the client organizations.

Benchmarking process for the Saudi construction industry organizations

Three categories were composed to facilitate benchmarking for construction industry organizations. The categorization was based on stages of progress illustrated in the achievement assessment graph. They are none and uncertainty stage, enlightenment stage and empowerment and wisdom stage. The three composed categories are:

- a- *Low TQM level.* Consisting of organizations that have obtained a score ranges between 0 and 390 points in the self-assessment process using QAISCI.
- b- *Medium TQM level.* Consisting of organizations that have obtained a score ranges between 400 and 740 points in the self-assessment process using QAISCI.
- c- *High TQM level.* Consisting of organizations that have obtained a score ranges between 750 and 1000 points in the self-assessment process using QAISCI.

The benchmarking process starts with selecting the list of organizations having the same type of business and then the recommended category for benchmarking can be chosen. In general, any organization looking for improvement through benchmarking can learn by contacting the chosen organizations or through meeting within the quality council...etc where they can exchange experience and the needed information for improvement can be obtained from the successful organizations.

In the following section, benchmarking process for design-consultant organizations and construction organizations will be presented since those two sectors are more important in the business of construction industry and they are in need for improvement more than the client organizations.

a- Benchmarking for consultant-design organizations

Consultant-design organizations can benchmark with other organizations having the same type of business. They can benchmark from organizations implemented TQM and reached a good TQM level. The recommended category for benchmarking for consultant-design organizations is the third category for both the private and public consultant-design organizations as illustrated in Table 6.9. Three organizations out of twenty-two organizations (13.64% of the organizations) are within this category. The third category has obtained a score ranging from 750 to 790 points meaning that those organizations have reached the empowerment stage and could be used for benchmarking.

TABLE (6.9): TQM LEVEL CATEGORIZATION FOR CONSULTANT–DESIGN ORGANIZATIONS

| Category | Consultant–Design Organization levels | Score Range | Actual Score | | Total Number | % Of Total |
|------------|---------------------------------------|-------------|--------------|------|--------------|------------|
| | | | min. | max. | | |
| Category 1 | Private–Low TQM level | 0–390 | 115 | 390 | 9 | 40.91 |
| Category 2 | Public&Private–Meduim TQM level | 400–740 | 425 | 690 | 10 | 45.45 |
| Category 3 | Public&Private–High TQM level | 750–1000 | 750 | 790 | 3 | 13.64 |
| | | | | | 22 | 100.0 |

b- Benchmarking for construction organizations

Construction organizations can benchmark with other organizations having the same type of business. They can benchmark from organizations reached a good TQM level. The recommended category for benchmarking for construction organizations is the third category as illustrated in Table 6.10. Nine organizations out of fourty-three

organizations (20.94%) are within this category. The third category has obtained a score ranging from 760 to 875 points meaning that those organizations have reached the empowerment stage and part of them in the beginning of wisdom stage.

TABLE (6.10):TQM LEVEL CATEGORIZATION FOR CONSTRUCTION ORGANIZATIONS

| Category | Private Construction Organization levels | Score Range | Actual Score | | Total Number | % Of Total |
|------------|--|-------------|--------------|------|--------------|------------|
| | | | min. | max. | | |
| Category 1 | Low TQM level | 0–390 | 170 | 375 | 10 | 23.25 |
| Category 2 | Meduim TQM level | 400–740 | 405 | 735 | 24 | 55.81 |
| Category 3 | High TQM level | 750–1000 | 760 | 875 | 9 | 20.94 |
| | | | | | 43 | 100.0 |

6.3.5 Benefits, barriers, and pitfalls of TQM implementation in the Saudi construction industry sector

The implementation process of TQM within the construction industry had gained many benefits and faced many obstacles. It was one of the objectives in this research to investigate the benefits from implementing TQM on the business performance, the barriers facing the implementation of TQM and the pitfalls that may effect on the TQM implementation in negative manner. The data for analyzing the benefits, barriers and pitfalls was collected through the interview using an additional questionnaire as presented in part II (questions no. 4, 5 and 6) in Appendix A.

Benefits: It was one of the objectives in this study to illustrate the opinion of respondents about the main benefit from implementing TQM. The participating organization indicated the main benefit they found from implementing TQM in the business. Of the 112 respondents who were aware of TQM, 57 respondents mentioned that the main benefit found in TQM was “cost savings”. Another 29 respondents cited that “ new customer won” was the main benefit since they are in the early stages of TQM journey. Also, 14 respondents indicated that “improved communication and

work efficiency” was the real benefit clear in the business. The remaining 12 respondents confirmed that “ improved staff morals” was the touched benefit. Table 6.11 presents the result of the study about the most important benefit from TQM implementation in the construction industry organizations.

Barriers: The 112 organizations were asked based on their knowledge to state the major barriers they faced in implementing TQM. 39 respondents forming 34.82% confirmed that the major barrier was “changing the organization culture” towards a quality culture. This is true in the case of government–owned organizations and sole proprietorship organizations. Of the 112 respondents, 35 mentioned that “limited resources to implement change” was a major barrier during TQM implementation. This barrier started to show in a high rate in the consultant-design organizations and it is probably the reason for low rate of progress towards TQM in such organizations that are mentioned in section 6.4.3. Also, 23 of respondents indicated that “keeping up the impetus” was a major barrier. The rest 15 respondents stated that “convincing top management” was the real barrier but the percentage of respondents is 13.39% meaning a low amount since TQM appears to succeed in Saudi Arabia as a result of top management commitment. The result of survey for major barrier facing TQM in construction industry organizations is illustrated in Table 6.12.

TABLE (6.11)· MAIN BENEFITS GAINED FROM TQM IMPLEMENTATION

| OPTION | ITEM | Frequency | Percentage |
|--------|--|-----------|------------|
| 1 | Cost savings | 57 | 50.84 |
| 2 | Improved staff morale | 12 | 10.72 |
| 3 | New customers won | 29 | 25.89 |
| 4 | Improved communication and work efficiency | 14 | 12.51 |
| | total | 112 | 100 |

TABLE (6.12) ; MAJOR BARRIERS FACING TQM IMPLEMENTATION

| OPTION | ITEM | Frequency | Percentage |
|--------|---------------------------------------|-----------|------------|
| 1 | convincing top management | 15 | 13.39 |
| 2 | Keeping up the impetus | 23 | 20.54 |
| 3 | Changing the organization culture | 39 | 34.82 |
| 4 | Limited resources to implement change | 35 | 31.25 |
| | total | 112 | 100 |

Pitfalls: Of the 112 respondents, 50 stated that “evaluation of performance by merit rating” was the main pitfall. It can be true especially in the early stages of TQM implementation. 27 respondents indicated that “lack of consistency of purpose” was the major pitfall. Another 23 respondents mentioned that “emphasis on short term process” was the main pitfall faced during TQM journey. The choice “mobility of management” was chosen by the remaining 12 respondents. Table 6.13 indicates the frequency and percentage of the respondents.

TABLE (6.13) MAJOR PITFALLS IN TQM IMPLEMENTATION

| OPTION | ITEM | Frequency | Percentage |
|--------|---|-----------|------------|
| 1 | Lack of consistency of purpose | 27 | 24.11 |
| 2 | Emphasis on short term process | 23 | 20.53 |
| 3 | Evaluation of performance by merit rating | 50 | 44.65 |
| 4 | Mobility of management | 12 | 10.71 |
| | total | 112 | 100 |

6.4 Approach limitations

The assessment process in this research is more subjective by nature and the applied scale varies based on the opinion of persons. As a result, a certain TQM level for an organization may be assessed higher than its actual TQM level. The reason is that the TQM consciousness is still immature and has not reached a high level. Also, at the time the TQM consciousness improves, the person may assess the organization lower than its actual TQM level since the person becomes more critical concerning TQM which means that the criticalness has increased along with the improved TQM consciousness.

CHAPTER 7

CONCLUSION

The assessment of TQM practices is considered as a key part of the TQM implementation strategy and organizations in other industries are increasingly using self-assessment instrument to drive continuous improvement and direct the TQM journey in moving the organizations towards business excellence.

The results in this research have raised some interesting issues and also reinforced the researcher's arguments that there is a clear need for an appropriate self-assessment instrument to assist in implementing and assessing TQM properly in the organizations within the construction industry sector in Saudi Arabia. This research builds a quality infrastructure and encourages knowing the level of TQM awareness through certain measures for the current quality performance in addition it presents essential data for benchmarking as a tool for learning from best practice within the Saudi construction industry organizations.

7.1 Self-assessment instrument for the Saudi construction industry organizations.

Developing self-assessment instrument, to assist in implementing TQM properly and to assess TQM practices within the Saudi construction industry organizations, was the main achievement in this research. The instrument provides the organizations with TQM generic model designed and developed in particular for the Saudi construction industry organizations that can lead to proper implementation for TQM in addition to self-assessment process for evaluating the TQM practices.

The developed self-assessment instrument was named "QAISCI" or the Quality Assessment Instrument for the Saudi Construction Industry and it has the potential to assist in implementing TQM and in assessing performance of construction industry organizations. It contains the following main parts:

- 1- TQM generic model.
- 2- Self-assessment questionnaire.
- 3- Scoring system.
- 4- Achievement assessment graph for progress evaluation.

The self-assessment instrument was developed through the following four stages:

a) The results of comparison between TQM models and overall performance measures used within the construction industry showed that MBNQA is the most suitable TQM model selected among 16 models used worldwide. MBNQA is more suitable for implementation within the construction industry sector for many reasons of which the followings:

- Easiness to understanding and updating.
- More perception for customers.
- Consistent in process.
- Encouraging continuous improvement.
- Containing guide to scoring system.

There was a necessity for a TQM generic model capable of guiding the construction industry organizations to implement TQM with consideration for the Saudi organizational culture and the requirements of construction industry to lead the business for improvement and avoiding barriers. MBNQA was modified to match the Saudi organizational culture such as the employees saudization and the requirements of construction industry such as the relationship with suppliers (or sub-contractors)... etc.

b) The criteria of the developed TQM generic model were used as a framework that was translated into a multi-item questionnaire for assessing quality performance. Statistical testing confirmed that the self-assessment instrument is valid and there is significant correlation between the scores obtained using the developed self-assessment questionnaire and the actual scores obtained from TQM assessors. The correlation coefficients were 0.651 and 0.795 for the sub-criteria level and criteria level respectively.

c) The objective scoring system for the self-assessment questionnaire was determined from responses using the criteria of the developed TQM generic model carried out for 112 organizations from the Saudi construction industry sector. The relative importance of each criterion in comparison with other criteria was the base for determining the weight. Analytical hierarchy process (AHP) was the method used for weight analysis. The analysis indicated that there is difference between the weights of criteria in the developed instrument and that of MBNQA equal almost to 15%.

d) The last part in the self-assessment instrument was the development of an achievement assessment graph. The graph was developed using the quality maturity grid presented by Crosby, the MBNQA score scale and the ECI achievement assessment graph. It provides the assessment process with a visible quality maturity level for the assessed organization.

7.2 Assessment of total quality management which are being applied within the Saudi construction industry organizations

The survey for assessment of quality management practices, carried out for 112 organizations from the Saudi construction industry sector, are having the following types:

- Client organizations.
- Consultant-design organizations.
- Construction organizations.

In this research, the following results were obtained:

(a) There is a fact that the quality movement in the Middle East and in particular in Saudi Arabia has a relatively short history in comparison with that in US or EU where the TQM concept is now adopted widely and applied extensively. The percentage of progress towards TQM within the Saudi construction industry organizations when compared with the construction organizations in the US and in the UK using the research studies by CII and the ECI, the followings can be concluded:

i) In the US, the TQM research carried out in 1989 showed that the survey for a sample of major contractors and clients, 50% had implemented a TQM within 24

months and the other 50% within 2 to 5 years of the survey. This means that in 1993 all these organizations were close to complete the TQM journey and implement their TQ strategy.

ii) In the UK, the TQM research that was carried out in the year 1993 by the ECI showed that the construction organizations have made 38% and the client organizations have made 36% progress towards TQM implementation.

iii) In Saudi Arabia, the results in this research showed that 17% of the surveyed organizations had implemented the quality management system within 1 to 2 years and the remaining 49% and 34% within 3 to 5 years and more than 5 years respectively. The level of TQM awareness for construction client, consultant-design, and construction organizations were determined through the achievement assessment graph developed in this study. The level of awareness for the three C's were: "Enlightenment" with a percentage of progress 46% towards TQM for clients organizations, "Awakening" with a percentage of progress 14.5% towards TQM for consultants-design organizations, and "Enlightenment" with a percentage of progress 27% towards TQM for construction organizations.

The client organizations become the best sector among the construction industry organizations in the achievement towards TQM as a result for implementing TQM earlier than others (3 to 5 years of the survey). Also client organizations are well known for their size and financial capability among those surveyed in this study

The general level of TQM awareness for the construction industry organizations in Saudi Arabia appears to be "Enlightenment" or exactly in the early stage of "Enlightenment" with a percentage of progress towards TQM equals to 32%. Therefore, the Saudi construction industry organizations are considered immature in terms of TQM.

The clients and contractors are realizing that continuous quality improvements have been made and some benefits in the business are visible. Consultants are seeing the first signs of improvement in the activities of the organizations but still in the early

stage of TQM journey. TQM program needs careful control at least two years to see the full benefits of TQM in the construction industry organizations or it will falter.

The researcher asks for more attention for TQM in the consultant-design organizations should be made to increase the progress towards TQM since all other sectors in the construction industry are moving ahead. The followings are the suggested solutions for improving the performance of the Saudi construction industry organizations:

- 1) One of the solutions for improving the private sector in the construction industry business especially the consultant-design organizations is through the “ merger ” with another organization having the same nature of business to form an organization capable of creating continuous improvement and competition in the market.
- 2) The movement of businessmen or investors in the construction industry sector towards the “ acquisition ” for some of the organizations facing troubles can improve the performance of those organizations. In addition, transforming the family organizations to an associate organization will lead to change in the management style and then more improvement in the performance of organizations.
- 3) Another solution for improving the construction industry business and for creating continuous improvement in the business could be through benchmarking with organizations “best in class”.

b) In this research, process benchmarking was recommended to a certain group of organizations determined through categorization based on the highest TQM achieved level for both the consultant-design organization and construction organizations. It was found that three consultant-design organizations from both the public and private sectors could be benchmarked for their high TQM level. Also, through the analysis for the construction organizations, nine construction organizations from the private sector could be benchmarked since they have achieved a high TQM level reaching almost the empowerment and wisdom stage.

c) Through the study, 57% of the participating organization indicated that the main benefit they found from implementing TQM in the business was “cost savings”. Also, it was found that 39% stated that the major barrier was “changing the organization culture” towards a quality culture and it can be true in case of organization owned by

a family. In addition, 50% of the participating organization illustrated that “evaluation of performance by merit rating” was the main pitfall and it can be true especially in the early stages of TQM implementation.

In general, the results of the survey indicated that QAISCI seems to provide the most accessible and useful guidance for TQM implementation and self-assessment of organizations. It contributes an infrastructure for implementing and assessing TQM in the Saudi construction industry organizations.

7.3 Recommendation for future study

It is suggested that a study in depth to research advanced topics in TQM related subjects such as the operational performance measures.

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Internet sites:

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APPENDICES

Appendix A

INTERVIEW QUESTIONNAIRE FOR THE SAUDI CONSTRUCTION INDUSTRY ORGANIZATIONS

Interview Questionnaire

PART I : General information

- # 1- What is your business (organization) type ?

- ① client organization ② consultant ③ contractor

- 2- The current Position of the person**

- ① General Manager ② TQM Manager ③ TQM Consul. ④ Quality Direc. ⑤ Quality Eng.

- 3- Number of years of your personal involvement in QM < 1yr 1-3 yr 4-7 yr >7 yr

- 4- When was QMS program implemented?
- | | | | | | |
|--------------------------|----------|--------------------------|----------|--------------------------|-----------|
| <input type="checkbox"/> | 1yr ago | <input type="checkbox"/> | 2yrs ago | <input type="checkbox"/> | 3yrs ago |
| <input type="checkbox"/> | 4yrs ago | <input type="checkbox"/> | 5yrs ago | <input type="checkbox"/> | >5yrs ago |

- ## 5- The location of the head quarter

- ② Jeddah ③ Dammam

PART II : Business questions

- ## 1- What is your ownership type ?

- ① Joint venture ② Sole propriet. ③ Partnership ④ Associate Co. ⑤ Other

- 2- What is your approximate number of employees ?

- ☐ 1-99 ☐ 100-499 ☐ 500-999 ☐ >999

- ### 3— What is your turnover in Millions?

- ☐ SR 1-9 ☐ SR 10-49 ☐ SR 50-99 ☐ SR >99

- 4- What most benefit have you seen from TQM ?

- ① cost savings ② improved staff morale

- ③ new customers won ④ improved communication and working efficiency

- 5- What major barrier have you faced during TQ journey?

- ① Convincing top management ② changing the organization culture

- ③ keeping up the impetus ④ limited resources to implement change

- ## 6- What major pitfall have you had during TQ journey?

- ① lake of consistency of purpose

- ③ evaluation of performance by merit rating ④ mobility of management

PART III : SELF-ASSESSMENT PROCESS

To what extent or emphasis the following statements are applied or used by the management staff through the quality management journey of your organization. The scale consists of :
0=none, 1=little emphasis, 3=some emphasis, good emphasis, 4=high emphasis and, 5=very high emphasis

| Serial | SELF-ASSESSMENT STATEMENTS | SCORING SYSTEM | |
|--------|--|---|-------|
| | | SCALE | SCORE |
| 1.1 | (a) Senior leadrs set and deploy organizational values, directions and performance expectation. | 0 none 1 little 2 some 3 good 4 high 5 high | 0 |
| 1.2 | (b) Senior leaders review organizational performance and capabilities. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| | (a) Impact on society of your product, service and operation are addressed. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| | (b) Senior leaders and employees actively support and strengthen your key communities. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| | (c) Leaders always support employee saudization in the organization. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| 2.1 | (a) Strategic planning process addresses customer expectation and market needs, competitive environment, strength and weakness of the organization's suppliers/partners, and financial and social factors. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| | (b) key strategic objective addresses the challenges identified in response to items mentioned in 2.1 (a). | 0 none 1 little 2 some 3 good 4 high 5 high | |
| 2.2 | (a) Action plans are developed and deployed to achieve key strategic objectives. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| | (b) Projected performance is compared with competitors performance, key benchmarks, goals and performance. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| 3.1 | (a) Customer requirements are continuously determined and targeted including market trends. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| 3.2 | (a) Organization builds relationships to acquire and satisfy customers for increasng repeat business and positive referrals. | 0 none 1 little 2 some 3 good 4 high 5 high | |
| | (b) Organization uses information from feedback to determine customers satisfaction and dissatisfaction. | 0 none 1 little 2 some 3 good 4 high 5 high | |

| Serial | SELF-ASSESSMENT STATEMENTS | SCORING SYSTEM | |
|--------|--|--|-------|
| | | SCALE | SCORE |
| 4.1 | (a) Organization gather data and information from all sources for performance measurements. (b) Organization analyze data and information to support organizational performance review and strategic planning processes. | <div>0</div> <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 4.2 | (a) Information and data are available and accessible to employees, suppliers/partners and customers. (b) Hardware and software systems are always current with business needs direction | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 5.1 | (a) Organization arranges and organizes work and jobs through teamwork to promote cooperation and innovation. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 5.2 | (a) Employees recieves education and training to support the achievement of the overall abjectives of the organization. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 5.3 | (a) Organization improves the work place health, saftey and ergonomics to provide employees with good work environment. (b) Organization support employees via services, benefits and policies. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 6.1 | (a) Organization manages key processes for product and service design. (b) Organization menages key production / delivery processes and their key performance requirements. (c) Quality Management System is documented, implemented and certified in the organizaion. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 6.2 | (a) Organization builds relationships with suppliers/partners based on measures of quality performance rather than price or schedule. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 6.3 | (a) Organization manages its key processes that leads to business growth and success. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |
| 6.4 | (a) Organization manages its key processes that support its daily operations and employees. | <div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> </div> | |

| Serial | SELF-ASSESSMENT STATEMENTS | SCORING SYSTEM | |
|---|---|---|-------|
| | | SCALE | SCORE |
| 7.1 | (a) Organization examines its performance and improvement in key business areas such as customer satisfaction. (b) Organization examines its current level and trends of product and service performance that are important to the customers. | <div>0</div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> | |
| 7.2 | (a) Organization examines its current financial and market place performance through key measures such as financial return/or economic value ..etc. | <div>0</div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> | |
| 7.3 | (a) Organization examines its current level and trends in key measures of work system performance and employee will-being , satisfaction and dissatisfaction and development. | <div>0</div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> | |
| 7.4 | (a) Evaluation for current level and trends in key measures of the operational performance of key design, production, delivery , business and support processes. (b) Suppliers quality are effectively monitored and the result are furnished to them. (c) Organization evaluates its trends in key measures of regulatory /legal compliance and citizenship. | <div>0</div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> | |
| Name of organization: Telephone number : Name of person : | | <div>0</div> <div>none</div> <div>little</div> <div>some</div> <div>good</div> <div>high</div> <div>very high</div> | |

PART IV : Pair-Wise Comparison Matrix

The following criterion needs to indicate its degree of importance for quality culture in comparison with the other criteria in your organization.

| QM CRITERIA | LEADERSHIP | STRATEGIC PLANNING | CUSTOMER AND MARKET FOCUS | INFORMATION AND ANALYSIS | HUMAN RESOURCE FOCUS | PROCESS MANAGEMENT | BUSINESS RESULTS | Scale | |
|---------------------------|------------|--------------------|---------------------------|--------------------------|----------------------|--------------------|------------------|-------------------|--|
| | | | | | | | | Equal 1 | |
| LEADERSHIP | | | | | | | | Intermediate 2 | |
| STRATEGIC PLANNING | | | | | | | | Weak 3 | |
| CUSTOMER AND MARKET FOCUS | | | | | | | | Intermediate 4 | |
| INFORMATION AND ANALYSIS | | | | | | | | Strong 5 | |
| HUMAN RESOURCE FOCUS | | | | | | | | Intermediate 6 | |
| PROCESS MANAGEMENT | | | | | | | | Demonstrated 7 | |
| BUSINESS RESULTS | | | | | | | | Intermediate 8 | |
| | | | | | | | | Absolute 9 | |

Appendix B

SELF-ASSESSMENT INSTRUMENT

SELF-ASSESSMENT INSTRUMENT

To what extent or emphasis the following statements are applied or used by the management staff through the quality management journey of your organization. The scale consists of : none, little emphasis,some emphasis, good emphasis, high emphasis and, very high emphasis

| SELF-ASSESSMENT STATEMENTS | | SCORING SYSTEM | | | | | | | | | | | | | | | | |
|----------------------------|--|--|------|--------|-----------|------|-------|-----------|---|---|----|----|----|----|--|--|--|--|
| Serial | | SCALE | | | | | SCORE | | | | | | | | | | | |
| 1.1 | (a) Senior leadrs set and deploy organizational values, directions and performance expectation. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>12</td><td>18</td><td>24</td><td>28</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 12 | 18 | 24 | 28 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 12 | 18 | 24 | 28 | | | | | | | | | | | | | |
| 1.2 | (b) Senior leaders review organizational performance and capabilities. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>12</td><td>18</td><td>24</td><td>28</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 12 | 18 | 24 | 28 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 12 | 18 | 24 | 28 | | | | | | | | | | | | | |
| | (a) Impact on society of your product, service and operation are addressed. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>12</td><td>18</td><td>24</td><td>28</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 12 | 18 | 24 | 28 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 12 | 18 | 24 | 28 | | | | | | | | | | | | | |
| | (b) Senior leaders and employees actively support and strengthen your key communities. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>12</td><td>18</td><td>24</td><td>28</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 12 | 18 | 24 | 28 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 12 | 18 | 24 | 28 | | | | | | | | | | | | | |
| | (c) Leaders always support employee saudization in the organization. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>12</td><td>18</td><td>24</td><td>28</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 12 | 18 | 24 | 28 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 12 | 18 | 24 | 28 | | | | | | | | | | | | | |
| 2.1 | (a) Strategic planning process addresses customer expectation and market needs, competitive environment, strength and weakness of the organization's suppliers/partners, and financial and social factors. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>23</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 10 | 15 | 20 | 23 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 10 | 15 | 20 | 23 | | | | | | | | | | | | | |
| | (b) key strategic objective addresses the challenges identified in response to items mentioned in 2.1 (a). | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>23</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 10 | 15 | 20 | 23 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 10 | 15 | 20 | 23 | | | | | | | | | | | | | |
| 2.2 | (a) Action plans are developed and deployed to achieve key strategic objectives. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>23</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 10 | 15 | 20 | 23 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 10 | 15 | 20 | 23 | | | | | | | | | | | | | |
| | (b) Projected performance is compared with competitors performance, key benchmarks, goals and performance. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>22</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 10 | 15 | 20 | 22 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 10 | 15 | 20 | 22 | | | | | | | | | | | | | |
| 3.1 | (a) Customer requirements are continuously determined and targeted including market trends. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>15</td><td>24</td><td>32</td><td>40</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 15 | 24 | 32 | 40 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 15 | 24 | 32 | 40 | | | | | | | | | | | | | |
| 3.2 | (a) Organization builds relationships to acquire and satisfy customers for increasing repeat business and positive referrals. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>15</td><td>24</td><td>32</td><td>40</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 15 | 24 | 32 | 40 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 15 | 24 | 32 | 40 | | | | | | | | | | | | | |
| | (b) Organization uses information from feedback to determine customers satisfaction and dissatisfaction. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>very high</td></tr><tr><td>0</td><td>5</td><td>15</td><td>24</td><td>32</td><td>40</td></tr></table> | none | little | some | good | high | very high | 0 | 5 | 15 | 24 | 32 | 40 | | | | |
| none | little | some | good | high | very high | | | | | | | | | | | | | |
| 0 | 5 | 15 | 24 | 32 | 40 | | | | | | | | | | | | | |

| SELF-ASSESSMENT STATEMENTS | | SCORING SYSTEM | | | | | | | |
|----------------------------|---|--|------------|-------------|-----------------|------------|------------|-----------------|--|
| | | SCALE | | | | | | | |
| | | SCORE | | | | | | | |
| 1.1 | (a) Organization gather data and information from all sources for performance measurements. (b) Organization analyze data and information to support organizational performance review and strategic planning processes. | <table><tr><td>none 0</td><td>little 4</td><td>some 8</td><td>good 12</td><td>high 16</td><td>very high 20</td></tr></table> | none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | |
| none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | | | | |
| 4.2 | (a) Information and data are available and accessible to employees, suppliers/partners and customers. (b) Hardware and software systems are always current with business needs direction | <table><tr><td>none 0</td><td>little 4</td><td>some 8</td><td>good 12</td><td>high 16</td><td>very high 20</td></tr></table> | none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | |
| none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | | | | |
| 5.1 | (a) Organization arranges and organizes work and jobs through teamwork to promote cooperation and innovation. | <table><tr><td>none 0</td><td>little 4</td><td>some 8</td><td>good 12</td><td>high 16</td><td>very high 20</td></tr></table> | none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | |
| none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | | | | |
| 5.2 | (a) Employees receives education and training to support the achievement of the overall abjectives of the organization. | <table><tr><td>none 0</td><td>little 4</td><td>some 8</td><td>good 12</td><td>high 16</td><td>very high 20</td></tr></table> | none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | |
| none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | | | | |
| 5.3 | (a) Organization improves the work place health, saftey and ergonomics to provide employees with good work environment. (b) Organization support employees via services, benefits and policies. | <table><tr><td>none 0</td><td>little 4</td><td>some 8</td><td>good 12</td><td>high 16</td><td>very high 20</td></tr></table> | none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | |
| none 0 | little 4 | some 8 | good 12 | high 16 | very high 20 | | | | |
| 6.1 | (a) Organization manages key processes for product and service design. (b) Organization manages key production / delivery processes and their key performance requirements. (c) Quality Management System is documented, implemented and certified in the organizaiaon. | <table><tr><td>none 0</td><td>little 3</td><td>some 6</td><td>good 9</td><td>high 12</td><td>very high 15</td></tr></table> | none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | |
| none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | | | | |
| 6.2 | (a) Organization builds relationships with suppliers/partners based on measures of quality performance rather than price or schedule. | <table><tr><td>none 0</td><td>little 3</td><td>some 6</td><td>good 9</td><td>high 12</td><td>very high 15</td></tr></table> | none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | |
| none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | | | | |
| 6.3 | (a) Organization manages its key processes that leads to business growth and success. | <table><tr><td>none 0</td><td>little 3</td><td>some 6</td><td>good 9</td><td>high 12</td><td>very high 15</td></tr></table> | none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | |
| none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | | | | |
| 6.4 | (a) Organization manages its key processes that support its daily operations and employees. | <table><tr><td>none 0</td><td>little 3</td><td>some 6</td><td>good 9</td><td>high 12</td><td>very high 15</td></tr></table> | none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | |
| none 0 | little 3 | some 6 | good 9 | high 12 | very high 15 | | | | |

| SELF-ASSESSMENT STATEMENTS | | SCORING SYSTEM | | | | | | | | | | | | | |
|---|--|--|--------|--------|--------|--------|--------|--------|----|----|----|----|----|----|--|
| Serial | | SCALE | SCORE | | | | | | | | | | | | |
| 7.1 | (a) Organization examines its performance and improvement in key business areas such as customer sotisfaction. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>55</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 55 | |
| | none | little | some | good | high | v.high | | | | | | | | | |
| 0 | 11 | 22 | 33 | 44 | 55 | | | | | | | | | | |
| | (b) Organization examines its current level and trends of product and service performance that are important to the customers. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>55</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 55 | |
| none | little | some | good | high | v.high | | | | | | | | | | |
| 0 | 11 | 22 | 33 | 44 | 55 | | | | | | | | | | |
| 7.2 | (a) Organization examines its current financial and market place performance through key measures such as financial return/or economic value ..etc. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>55</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 55 | |
| none | little | some | good | high | v.high | | | | | | | | | | |
| 0 | 11 | 22 | 33 | 44 | 55 | | | | | | | | | | |
| 7.3 | (a) Organization examines its current level and trends in key measures of work system performance and employee will-being , satisfaction and dissatisfaction and development. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>55</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 55 | |
| none | little | some | good | high | v.high | | | | | | | | | | |
| 0 | 11 | 22 | 33 | 44 | 55 | | | | | | | | | | |
| 7.4 | (a) Evaluation for current level and trends in key measures of the operational performance of key design, production, delivery , business and support processes. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>57</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 57 | |
| | none | little | some | good | high | v.high | | | | | | | | | |
| | 0 | 11 | 22 | 33 | 44 | 57 | | | | | | | | | |
| (b) Suppliers quality are effectively monitored and the result are furnished to them. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>57</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 57 | | |
| none | little | some | good | high | v.high | | | | | | | | | | |
| 0 | 11 | 22 | 33 | 44 | 57 | | | | | | | | | | |
| | (c) Organization evaluates its trends in key measures of regulatory /legal compliance and citizenship. | <table><tr><td>none</td><td>little</td><td>some</td><td>good</td><td>high</td><td>v.high</td></tr><tr><td>0</td><td>11</td><td>22</td><td>33</td><td>44</td><td>57</td></tr></table> | none | little | some | good | high | v.high | 0 | 11 | 22 | 33 | 44 | 57 | |
| none | little | some | good | high | v.high | | | | | | | | | | |
| 0 | 11 | 22 | 33 | 44 | 57 | | | | | | | | | | |
| TOTAL SCORE | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

